Ownership and the endowment effect in adults and children

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To my mother,

for inspiring me to march to the beat of my own drummer

and patiently tolerating the consequences.

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Abstract (German)

Der Endowment-Effekt—d.h. die Verkaufspreise von Eigentümer sind konsistent höher als die Kaufpreise von Nicht-Eigentümern—ist ein robustes Phänomen, das der neoklassischen ökonomischen Theorie widerspricht. Diese Dissertation trägt mit zwei unterschiedlichen Ansätzen zu der Literatur über den Endowment-Effekt bei. Im ersten Teil, erforschen wir die psychologischen Mechanismen hinter dem Konzept der Eigentümerschaft. Das heißt, wir suchen eine Antwort auf die Frage, ob Eigentümerschaft, psychologische Eigentümerschaft, oder sogar beide den Endowment-Effekt verursachen. Auf der Basis von drei Laborexperimenten, in dem wir auf unterschiedliche Art und Weise Eigentümerschaft manipulierten, zeigen wir, dass der Endowment-Effekt unabhängig von psychologischer Eigentümerschaft auftritt. Eigentümerschaft und nicht psychologische Eigentümerschaft scheint also die Ursache des Endowment-Effekts zu sein. Im zweiten Teil dieser Dissertation, tragen wir zu den spärlichen wissenschaftlichen Ergebnissen über den Endowment-Effekt bei Kindern bei. Wir entwickeln dabei eine neue Methode, um den Effekt zu messen—sogenannte Preference-Cards—die auf Standardmaße aus der erwachsenen Forschung basiert, jedoch Kind-gerecht verpackt ist. In zwei Experimente demonstrieren wir, dass Kinder einen Endowment-Effekt zeigen, der signifikant größer ist als der bei Erwachsenen. Zudem zeigen wir, dass die Preference-Card-Methode ein vielversprechendes Maß für das Messen des Endowment-Effekts bei Individuen unterschiedlichen Alters ist, und diskutieren mögliche Vorteile gegenüber dem Standardmaß.

Abstract (English)

The endowment effect—i.e., owners' selling prices are consistently higher than nonowners' buying prices—is a robust phenomenon that contradicts neoclassical economic theory. This dissertation contributes to the endowment effect literature with two distinct approaches. With the first, we explore the psychological mechanisms behind the concept of ownership. More specifically, we address the question whether factual ownership, psychological ownership, or both cause the endowment effect. Based on three laboratory experiments, in which we implement different manipulations of ownership, we show that the occurrence of the endowment effect is independent of psychological ownership. We conclude that factual and not psychological ownership causes the endowment effect. With the second approach, we contribute to the sparse findings regarding the presence of the endowment effect in children. We develop a new measure of the endowment effect—preference-cards—that builds on standard measures from the adult literature but involves a scenario that is appropriate for children. In two experiments, we then provide evidence of an endowment effect in children that is significantly larger in magnitude than that observed in adults. We also demonstrate that the preference-cards measure is a sound measure of the endowment effect in individuals of different ages and discuss its advantages over the previously used measure.

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1. Introduction

1.1 Theoretical background

According to the Coase theorem of neoclassical economic theory, in a market with no transaction costs, individuals should attribute the same value to a good regardless of whether they are considering its acquisition or loss (Willig, 1976). There is extensive evidence, however, that the minimum monetary amount owners are willing to accept in exchange for relinquishing a good is consistently higher than the maximum amount nonowners are willing to pay to purchase that good (e.g., Kahneman, Knetsch, & Thaler, 1990). The robustness of this so-called *endowment effect* has been demonstrated in at least two meta-analyses (e.g., Horowitz & McConnell, 2002; Sayman & Öncüler, 2005).

The currently dominant explanation of the endowment effect stems from Kahneman and Tversky's (1979) prospect theory. A central tenet of this theory is that perceptions of value are based on changes in wealth or welfare, rather than final states. Because individuals are loss averse, they expect negative changes, or losses, to have a greater hedonic impact than positive changes, or gains (see also Tversky & Kahneman, 1991). Thus, a loss (indicated by *a* in Figure 1.1) is associated with a greater decrease in value than the respective increase in value associated with an equally large gain (*b*). Whether a change is experienced as a loss or a gain is, in turn, dependent on one's initial reference point.

Based on this notion of *reference dependency*, a change in ownership status is sufficient to alter one's reference point and, with that, subsequent perceptions of value. That is, owners focus on the potential loss of the good if it were to be sold, whereas nonowners focus on the potential gain if the good were to be purchased (cf., Carmon & Ariely, 2000). Therefore, owners are more motivated to retain possession of the good than nonowners are to acquire it and thus demand more than nonowners are willing to pay. This explanation of the endowment effect is supported by a growing body of research indicating that the computation

of value is not an absolute measure but, rather, is dependent on a changing reference point (Bateman, Munro, Rhodes, Starmer, & Sugden, 1997; De Martino, Kumaran, Holt, & Dolan, 2009).

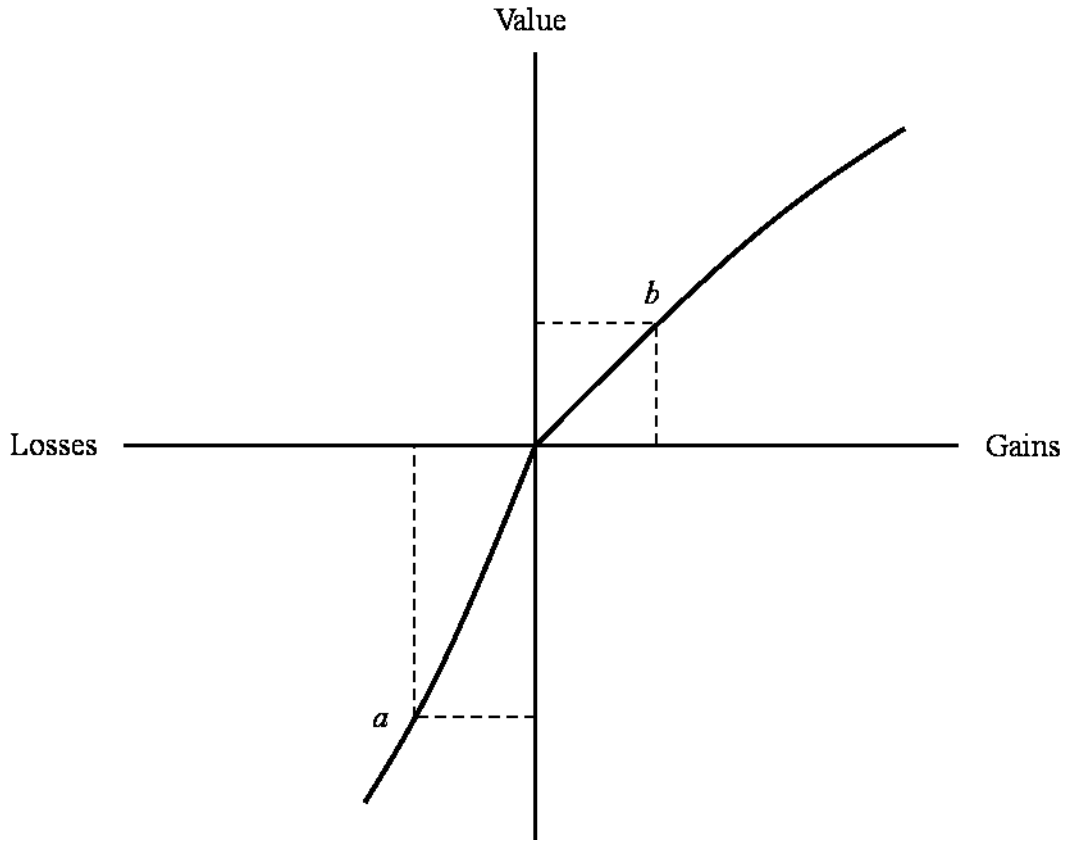

Figure 1.1 Value function according to prospect theory. The origin represents an individual's reference point. Point *a* represents negative shift from reference point (loss) and the resulting, comparatively large reduction in value. Point *b* represents positive shift from reference point (gain) and the resulting, comparatively small increase in value.

Still, the endowment effect has been the focus of much debate over the past decades. For example, some researchers argue that the effect results from participants not understanding experimental procedures (Plott & Zeiler, 2005). However, although there is evidence that the magnitude of the endowment effect is smaller when participants have more time to learn the experimental procedures through practice rounds, the effect remains robust (Sayman & Öncüler, 2005). Other researchers have demonstrated evidence that the

endowment effect may simply be the result of strategic misrepresentation—i.e., owners overstate their true minimum willingness to accept and nonowners understate their true maximum willingness to pay with the goal of maximizing profit. When researchers apply procedures that punish strategic misrepresentation and provide participants the opportunity to learn that such behavior is maladaptive, the endowment effect decreases in magnitude or even disappears (Brookshire & Coursey, 1987; Shogren, Shin, Hayes, & Kliebenstein, 1994). However, other studies have failed to demonstrate this effect (Kahneman et al., 1990; Knez, Smith, & Williams, 1985; Morrison, 1997). Also, in a meta-analysis Horowitz & McConnell (2002) did not find strong evidence that the magnitude of the endowment effect decreases with repeated trials. Thus, despite numerous attempts to show that the endowment effect is merely a research artefact, researchers continue to collect evidence that the effect truly does play a role in individuals' value judgements.

Endowment effect researchers have conducted extensive studies exploring possible boundary conditions of the effect. The magnitude of the endowment effect, for instance, varies dramatically depending on the type of good used in the study. The effect magnitude for nonmarket goods such as health, public services, and environmental goods has been shown to be, on average, more than three times larger than that for ordinary market goods such as coffee mugs, chocolate bars, and key chains (Horowitz & McConnell, 2002). In the case of exchange goods such as tokens, the effect is even smaller (Horowitz & McConnell, 2002; Kahneman et al., 1990). The type of measure used to assess value judgements also influences the magnitude of the effect (Horowitz & McConnell, 2002; Sayman & Öncüler, 2005), although results differ in terms of which type of measure produces the most accurate estimates.

Comparatively little is known about the psychological mechanisms behind the endowment effect as well as its development across the lifespan. Recent findings indicate that attention processes may play a role—owners appear to focus their attention on the good,

whereas nonowners focus their attention on the money (Carmon & Ariely, 2000; Ashby, Dickert, & Glöckner, 2012). There is also evidence that owners and nonowners retrieve information about different aspects of the good from memory, which in turn may cause valuations to be higher in owners (Johnson, Häubl, & Keinan, 2007). Other studies suggest that subjective feelings of ownership (hereafter referred to as *psychological ownership*) may also be important (Peck & Shu, 2009; Reb & Connolly, 2007; Shu & Peck, 2011; Wolf, Arkes, & Muhanna, 2008). Finally, there is evidence that children demonstrate an endowment effect when provided the opportunity to trade their endowment for a different good (Harbaugh, Krause, & Vesterlund, 2001; Lucas, Wagner, & Chow, 2008).

A thorough understanding of the psychological mechanisms behind the endowment effect is important for understanding how individuals form value judgments. Such research also increases the applicability of the endowment effect in practical settings. For instance in legal practice, such as when determining cases in which compensation for a (felt) loss is justified as well as how high that compensation should be. It may also be relevant in the area of sales—for instance as a means to increase consumers' willingness to pay. Knowledge of the developmental course of the endowment effect is necessary to understand the way in which children and adolescents make value judgments. It also has value in practical contexts, as children and adolescents are increasingly involved in legal cases (e.g., family court) and are active consumers.

1.2 Dissertation summary

This dissertation contributes to the endowment effect literature with two distinct approaches. First, we explore the psychological mechanisms behind the concept of ownership in endowment effect experiments. More specifically, we distinguish between the effects of factual ownership and psychological ownership on individuals' valuations (Study 1). Second, we contribute to the sparse findings regarding the presence of the endowment effect in

children and develop a new measure to compare the effect in children and adults (Study 2 and 3). In the course of completing this dissertation, we examined a total of 949 participants (see Table 1.1 for overview of studies and participants). The three studies described in this manuscript include 787 of those participants, comprising eight distinct samples in five laboratory experiments and one pre-test. The remaining 162 participants were examined in two additional pretests that served as preparation for the studies included in this dissertation.

Table 1.1

Overview of Studies and Participants Included in this Dissertation

Study 1: Psychological ownership is not a condition of the endowment effect
Experiment 1: 141 adults
Experiment 2: 165 adults
Experiment 3: 103 adults
Study 2: Towards a new measure of the endowment effect in children
Pretest: 85 children
Experiment: 89 children, 54 adults
Study 3: The endowment effect in children and adults
Experiment: 70 children, 80 adults
Additional pretests:
Pretest 1: 68 adults
Pretest 2: 94 adults

1.2.1 Study 1

Psychological ownership is not a condition of the endowment effect

When examining the mechanisms behind the endowment effect, researchers attempt to cause the effect by inducing a shift in participants' reference points through the manipulation of ownership status. However, there has been little consistency to date regarding the methods used to bring about a sense of ownership in some participants and prevent it in others. In the typical endowment effect experiment, ownership status is manipulated by assigning participants to one of two groups—owners, who are given possession of the good (often referred to as "sellers"), and non-owners, who are given the opportunity to purchase the good ("buyers" or "choosers"). Often, participants are simply informed of their ownership status through written or verbal instructions and may or may not be provided with the opportunity to physically inspect the good prior to reporting their valuations. Duration of ownership, too, varies considerably between studies (cf., Sayman & Öncüler, 2005). Such differences in experimental procedures are problematic, as ownership has been shown in recent years to be more complex than previously assumed. Thus, different manipulations of ownership may potentially lead to different reference point shifts.

Researchers have proposed a bi-variate model of ownership that differentiates between *factual* and *psychological* (sometimes also referred to as subjective) ownership (Pierce, Kostova, & Dirks, 2003), which both can occur in the absence of the other. Factual ownership refers to a person's (legal) right to possess a good as well as control others' access to it—this is the type of ownership typically referred to in the context of endowment effect research. Psychological ownership, on the other hand, is defined as "the state in which individuals feel as though the target of ownership or a piece of that target is 'theirs'" (Pierce et al., 2003: 86)—this type of ownership is typically ignored in studies on the endowment effect (for exceptions, see Peck & Shu, 2009; Reb & Connolly, 2007; Shu & Peck, 2011; Wolf, Arkes, &

Muhanna, 2008). Whereas factual ownership is elicited simply by informing individuals of their ownership status, psychological ownership is induced through the following three key experiences (Pierce et al., 2003): 1) controlling the good (e.g., Peck & Shu, 2009; Reb & Connolly, 2007); 2) becoming familiar with the good; and/or 3) investing the self into the good (e.g., Kiesler & Kiesler, 2004). Duration of factual ownership has also been shown to increase psychological ownership (Heyman, Orhun, & Ariely, 2004; Strahilevitz & Loewenstein, 1998).

There is evidence that psychological ownership may lead to a reference point shift and, subsequently, differences in valuations between individuals high and low in psychological ownership (Peck & Shu, 2009; Reb & Connolly, 2007; Shu & Peck, 2011). Thus, experimental procedures that do not account for psychological ownership may bias their findings by inadvertently causing a reference point shift due to psychological rather than or in addition to factual ownership. For example, if owners have the opportunity to touch (and thus physically control) the good, whereas nonowners do not, the former may experience greater psychological ownership than the latter, which may in turn cause owners to report higher valuations than nonowners. In this way, psychological ownership is often unwittingly confounded with factual ownership—i.e., the difference in valuations that is attributed to differences in factual ownership may actually be due to differences in psychological ownership (for examples of confounded ownership manipulations, see Morrison, 2000; List, 2003, 2004).

Unfortunately, because so few studies on the endowment effect have taken psychological ownership into consideration, it is not yet clear what role psychological ownership has in the endowment effect. As a consequence, the possibility that the endowment effect may be caused by psychological rather than factual ownership has also not yet been ruled out. For instance, of the few studies that have examined psychological ownership in the context of the endowment effect, some show that psychological ownership causes the effect in

addition to factual ownership (e.g., Peck & Shu, 2009), whereas others argue that psychological ownership is the sole cause of the effect (e.g., Reb & Connolly, 2007). Still others indicate that psychological ownership may simply strengthen the effect that factual ownership has in causing the endowment effect (e.g., Strahilevitz & Loewenstein, 1998). Thus, in Study 1, we sought to answer the question whether factual ownership, psychological ownership, or both cause the endowment effect. The purpose in doing so was to determine whether the definition of the endowment effect must be expanded to include psychological ownership or completely revised in that psychological ownership replaces factual ownership as the cause of the endowment effect.

In Experiment 1, we attempted to replicate previous findings demonstrating that the endowment effect is caused by both factual (Peck & Shu, 2009) and psychological ownership (Peck & Shu, 2009; Reb & Connolly, 2007). As in previous studies, we manipulated psychological ownership through participants' ability to touch the good—this stems from the idea that controlling a good (here in a physical sense) causes psychological ownership (cf., Pierce et al., 2003). Touch may influence participants' valuations through means other than psychological ownership, such as by providing additional information on the good (e.g., weight, texture) that may be indicative of quality or, in the case of positively or neutrally valenced goods, through affective reactions (Peck & Wiggins, 2006). Thus, we chose a good that would be unlikely to cause an affective reaction and would also be sufficiently familiar to participants to the extent that touch would provide little or no information that participants did not already possess: a coffee mug.

We found that touch only led to greater psychological ownership in participants who owned the good, while it resulted in greater valuations in both owners and nonowners. In addition, we observed an endowment effect regardless of whether owners and nonowners experienced different levels of psychological ownership. Thus, we concluded that: 1) the effect of touch on valuations was not due to psychological ownership as assumed by previous

studies (e.g., Peck & Shu, 2009; Reb & Connolly, 2007); and 2) the occurrence of the endowment effect is not dependent on psychological ownership.

In Experiment 2, we conducted an additional replication study with procedural modifications meant to rule out possible explanations for the disparities between the findings of Experiment 1 and previous research. That is, we controlled the number of times that participants touched the good while keeping exposure times constant across all conditions. The findings of Experiment 2 contrasted greatly with those of Experiment 1. We found that the ability to touch led to neither greater psychological ownership nor greater valuations. Factual ownership, however, significantly increased psychological ownership regardless of whether participants touched the good and lead to a trend for an endowment effect. We conclude that the findings of Experiment 1 regarding the effect of touch on valuations may have been an inadvertent exposure effect, whereas the lack of an effect of factual ownership on psychological ownership for participants in the no-touch condition may have been due to the ownership manipulation being less convincing. Overall, because touch did not influence psychological ownership as intended in both Experiment 1 and 2 and lead to greater valuations due to mechanisms other than psychological ownership, we conducted a third experiment using a manipulation of psychological ownership aimed to avoid these issues.

In Experiment 3, we further examined the roles of factual and psychological ownership in the endowment effect by manipulating psychological ownership in a manner more similar to everyday ownership experiences, yet that is still related to the key experience of controlling the good. We divided participants into ownership status groups associated in everyday experience with the greatest, comparatively moderate, and lowest degree of control over a good—owners, borrowers, and nonowners, respectively. That is, whereas owners can do anything they like with a good, including damaging or discarding it, borrowers may use the good but must ensure that it remains in good condition, and nonowners have no control over the good whatsoever. We expected that owners would report the highest, nonowners the

lowest, and borrowers comparatively moderate levels of psychological ownership. The data supported this hypothesis. In addition, we observed an endowment effect between owners and nonowners. The increased psychological ownership observed in borrowers as compared to nonowners, however, did not result in greater valuations in the former. Thus, we concluded that factual ownership is necessary for the endowment effect to occur, while psychological ownership alone is not sufficient to cause the effect. Overall, the findings from all three experiments indicated that the endowment effect is caused by factual and not psychological ownership.

1.2.2 Study 2

Towards a new measure of the endowment effect in children

The findings in Study 1 contributed to our understanding of the origin of the endowment effect, demonstrating that factual ownership, and not psychological ownership as proposed by some researchers, causes the effect. Still, the question remains whether the effect of factual ownership on individuals' valuations is a stable characteristic of human judgment or simply a behavior highly dependent on experience. There exists evidence in support of both notions. Some researchers, for instance, claim that the valuation disparity characteristic of the endowment effect is due to a *sell high, buy low* impulse learned in everyday trading experiences and diminishes or even disappears when individuals are provided the opportunity to learn that such behavior is maladaptive in the experimental context (Brookshire & Coursey, 1987; Shogren, Cho, Koo, List, Park, Polo, & Wilhelmi, 2001; Shogren et al., 1994). Still others claim that the endowment effect is caused by a lack of everyday trading experience, in that trading novices but not experienced traders demonstrate the effect (List, 2003, 2004). There is also evidence, however, that the endowment effect is unaffected by experience (Harbaugh et al., 2001; Kahneman et al., 1990; Knez et al., 1985; Morrison, 1997).

However, the vast majority of studies to date examining the role of experience in the endowment effect have focused on adult participants. Thus, most examine gains in experience over relatively brief periods—often only minutes or hours, such as when experience is gained through repeated experimental trials (e.g., Coursey, Hovis, & Schulze, 1987). If the endowment effect is a stable characteristic of human judgment, one should expect the effect to remain relatively stable even across long time periods—i.e., the effect magnitude should be similar in children and adults. If, however, the endowment effect is dependent on trading experience, the effect magnitude should differ considerably between children and adults, as the latter have substantially more experience trading goods.

To date, only two studies known to the authors have examined the endowment effect in children—both observed evidence of the effect (Harbaugh et al., 2001; Lucas et al., 2008). The only study known to the authors that compared the magnitude of the endowment effect in children and adults demonstrated that the effect is stable across the age groups (Harbaugh et al., 2001). Thus, there is some evidence that the endowment effect is not dependent on trading experience.

However, there is yet to be a study that compares the endowment effect between children and adults using a measure that adheres to current methodological standards in adult endowment effect research. Thus, in Study 2 we first developed a new measure of the endowment effect—*preference-cards*—that is structurally identical to a standard measure of the endowment effect used in adults yet involves a scenario appropriate for use with children.

We first pre-tested this measure in a sample of primary school children and made methodological changes accordingly. Then, we assessed the endowment effect in a sample of six- to ten-year-olds and validated the preference-card measure by applying it to a sample of adults. In doing so, we found evidence of an endowment effect in children as well as an endowment effect in adults of a magnitude in line with findings from previous studies (cf., Horowitz & McConnell, 2002). Thus, our findings both support previous research on the

endowment effect in children (Harbaugh et al., 2001; Lucas et al., 2008) and indicate that the preference-card measure can be used to compare the effect in children and adults.

1.2.3 Study 3

The endowment effect in children and adults

In Study 3, we used the preference-card measure developed in Study 2 to compare the magnitude of the endowment effect in primary school children and adults. The goal of this study was to address the question discussed above of whether the endowment effect is a stable characteristic of human judgment or a behavior dependent on trading experience. If the former is true, we would expect the endowment effect to be similar in magnitude for children and adults. However, if the latter is true, we would expect the magnitude to differ considerably between the two age groups—we had no hypothesis regarding the direction of this difference, as there is evidence both that the effect is likely smaller (e.g., Brookshire & Coursey, 1987; Shogren et al., 1994) and larger in children (List, 2003, 2004).

We also tested whether we were successful in developing a child-friendly measure of the endowment effect that still conforms to the standards in adult research. To do so, we additionally measured the endowment effect in adults using the standard on which the preference-card measure was based. If both the standard and the preference-card measure perform in a similar manner, we would expect to find similar results using both measures in a single sample. Finally, in order to compare the performance of the preference-card measure with that of the standard measure previously used in child samples, we measured the endowment effect in both children and adults using the dichotomous choice measure.

The results of Study 3 indicate that children show a significantly larger endowment effect than adults. This finding supports the preliminary evidence collected in Study 2. Thus, the endowment effect does not appear to be a stable characteristic of human judgment. Instead, the findings indicate that the effect may be dependent on trading experience, which is

consistent with previous studies indicating that the endowment effect occurs in trading novices but not experienced traders (List, 2003, 2004).

The findings also indicate that we successfully developed a child-friendly measure of the endowment effect that still conforms to the standards in adult research, as we observed similar magnitudes of the endowment effect in adults using both the preference-card measure and a standard measure. In addition, we demonstrated that the preference-card measure is more reliable and economical that the dichotomous choice measure when comparing different age groups.

1.2.4 Additional pretests

The additional pretests mentioned in this manuscript primarily served the purpose of designing the experimental procedure and materials used in Study 1, Experiment 1, which formed the foundation of all subsequent studies.

In Pretest 1, we performed a replication of the no-touch condition used in Peck & Shu (2009), in which participants were allowed to touch the good only inside its packaging (the procedure and materials used were identical to those in Study 1, Experiment 1). The purpose of this pretest was twofold: 1) determine whether the form of the no-touch condition used by Peck & Shu (2009) should be included in future studies; 2) test the usability of the experimental procedure and materials, especially with regard to the English translations of items and instructions used in past studies. Regarding the first goal, we decided against including Peck & Shu's variant of the no-touch condition in additional studies. The differences between participants in the touch and Peck and Shu's no-touch conditions were descriptively similar to those reported in Study 1, Experiment 1. However, the observed effect sizes were comparatively small. As we had limited resources with which to conduct the studies, we decided against including this condition in future studies, as we would likely not have been able to achieve the statistical power necessary to test effects related to this

condition. In terms of the second goal, we were satisfied with the procedures and materials used in the pretest and thus made no changes when conducting Study 1, Experiment 1.

The purpose of Pretest 2 was to test an alternative manipulation of psychological ownership suggested by the work of Pierce and colleagues (2003), according to which identification with a good should lead to increased psychological ownership. We tested this in a sample of students at Beloit College—a small, liberal arts college in the United States that traditionally encourages a high level of personal identification in its students. Due to limited experimental facilities available at the time of the pretest, the study was conducted in survey form using an English version of the instructions and materials used in Study 1, Experiment 1. The questionnaire additionally included a picture of either a generic black ballpoint pen (no-identification condition) or a blue and yellow (the traditional colors of the college) Beloit College pen (identification condition). Based on the definition of psychological ownership by Pierce and colleagues (2003), we expected participants in the identification condition to report higher levels of psychological ownership than those in the no-identification condition. However, the data did not support this hypothesis; rather, participants in both condition reported similar levels of psychological ownership. This is possibly due to the use of pictures rather than actual pens. We also failed to find the expected endowment effect, which we attributed to the survey form and subsequent lack of control over possible confounding variables such as length of exposure to the good. Thus, we ultimately decided to disregard the findings due to methodological shortcomings. We did not pursue this line of research further, as we determined that it would go beyond the scope of this dissertation to explore the effects of all three key experiences of psychological ownership—instead, we decided to focus on the key experience of controlling the good.

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2. Study 1

Psychological ownership is not a condition of the endowment effect

Until recently, the definition of ownership in experiments examining the endowment effect has been limited to the concept of factual ownership: i.e., owners are given possession of the good, while nonowners have the opportunity to purchase the good (cf., Kahneman, Knetsch, & Thaler, 1990). The bi-variate understanding of ownership elaborated by Pierce, Kostova and Dirks (2003) and supported by various studies (Beggan & Brown, 1994; Etzioni, 1991; Friedman, 2008; Furby, 1980; Neary, Friedman & Burnstein, 2009) has only recently received attention in endowment effect research (cf., Peck & Shu, 2009; Reb & Connolly, 2007; Wolf, Arkes, & Muhanna, 2008). This concept differentiates between *factual* and *psychological* ownership. Factual ownership refers to a person's (legal) right to possess a good as well as control others' access to it. Psychological ownership, on the other hand, is defined as "the state in which individuals feel as though the target of ownership or a piece of that target is 'theirs'" (Pierce et al., 2003: 86).

The distinction between factual and psychological ownership is important, as each facet may occur in the absence of the other. For example, a person receiving an unsuitable gift may not feel a sense of ownership towards it, even though he owns it factually. On the other hand, an employee may feel a sense of ownership towards her work computer despite the fact that her employer is the true factual owner. The at times incongruent occurrence of factual and psychological ownership has been demonstrated empirically. For example, consumers have been shown to develop psychological ownership towards choice options that they do not own during the deliberation period of the decision making process (cf., Carmon, Wertenbroch, & Zeelenberg, 2003; Dhar & Wertenbroch, 2000; Hoch & Loewenstein, 1991).

Because psychological ownership is typically ignored in endowment effect research, it is not yet clear which aspect of ownership is truly responsible for the effect. Thus, in order to

understand how individuals make value judgments, it is important to determine whether the robust discrepancy between the valuations of owners and nonowners is caused by factual ownership, psychological ownership, or both. The few studies to date that have addressed this question provide no clear answer. While some researchers claim that psychological ownership is the sole cause of the endowment effect (Reb & Connolly, 2007), others have shown that both factual and psychological ownership may be causes (Peck & Shu, 2009; Wolf, et al., 2008).

In this study we sought to answer the question whether factual ownership, psychological ownership, or both cause the endowment effect. To do so, we first conducted two replications of previous studies in which we manipulated both factual and psychological ownership. The results of these replications suggested that psychological ownership is not necessary for an endowment effect to occur. In addition, they indicated that the methods used in previous studies may not be effective in eliciting psychological ownership. We then conducted a third experiment in which we manipulated ownership in a manner more characteristic of everyday ownership experience. The observed differences in valuations between conditions suggested that psychological ownership is also not a sufficient condition of the endowment effect. Therefore, we concluded that factual and not psychological ownership causes the endowment effect.

2.1 Experiment 1

We replicated previous studies in which both factual and psychological ownership were manipulated in an experimental setting—the former by informing participants that they either do or do not own a university coffee mug and the latter by varying participants' ability to touch the mug (cf., Peck & Shu, 2009; Reb & Connolly, 2007). Using touch as a proxy for psychological ownership stems the theory that the ability to control an object increases

individuals' feelings that the object is "theirs" (Furby, 1978; Pierce, et al., 2003). The concept *control* is extended in this paradigm to include physical manipulation.

Based on previous research, we expected participants to report greater psychological ownership when they have the ability to touch the good, regardless of whether they actually own it (Hypothesis 1). We also expected both the ability to touch and factual ownership to lead to higher valuations of the good (Hypothesis 2 and 3, respectively). However, how factual ownership would affect psychological ownership and whether factual ownership and touch would interact to affect psychological ownership remained open questions.

2.1.1 Method

Participants and design. Participants were 141 individuals from a psychology participant pool at the University of Erfurt, who participated in exchange for either cash (on average approximately 4.00 €) or a University of Erfurt coffee mug, depending on transaction outcomes. The mean age was 22 years (SD = 2.86). 102 participants were female. The experiment had a 2 (factual ownership: owners vs. nonowners) x 2 (psychological ownership: touch vs. no-touch) between-subjects design. Participants were randomly assigned to one of the four conditions, which were run simultaneously. Each session included a maximum of 16 participants and lasted approximately 15 minutes.

Procedure and materials. Upon entering the psychology lab, participants were first shown the mug as a group by the experimenter. They were told that they could purchase similar mugs at the college store and would be evaluating the mug in a written questionnaire. Participants were then seated in individual cubicles containing a questionnaire and, in the touch conditions, the mug.

Participants in the no-touch condition were asked to evaluate the mug shown to them by the experimenter. Participants in the touch condition were asked to pick up and examine the mug on the table in their cubicle before proceeding with the questionnaire. Factual

ownership was manipulated by informing participants that they either: owned a mug and would have the opportunity to sell it back to the experimenter if they chose (owners); or did not own a mug but would have the opportunity to choose between receiving a mug or cash (nonowners). See Appendix A for original instructions.

Participants then read detailed instructions on the Becker-DeGroot-Marschak (BDM) (1964) measure, which we used to assess judgements of value. We chose this measure of the endowment effect because it is *preference revealing*—meaning that it punishes individuals who do not report their true preferences (i.e., for owners, not being able to sell their endowed good for a sum of money that they actually would have been willing to accept; for nonowners, not being able to purchase the good at a price that they actually would actually have been willing to pay). It is also one of the most frequently used measures in endowment effect research (Horowitz & McConnell, 2002) and has been shown to produce more reliable results than alternative preference revealing measures (Shogren, Cho, Koo, List, Park, Polo, & Wilhelmi, 2001).

The BDM measure asked participants to respond to a series of 40 dichotomous choices between the mug and amounts of money ranging from 20 cents to 8.00 € in increments of 20 cents. Owners were asked whether they would rather keep the mug or sell it for the given sum of money, while nonowners were asked whether they would rather receive the mug or the given sum of money (see Appendix A for original questionnaire). For owners, valuations were calculated as the smallest amount of money for which participants stated that they would rather sell their mug. For nonowners, valuations were calculated as the largest amount of money for which participants stated that they would rather receive the mug. In the presence of an endowment effect, owners' valuations should be higher than those of nonowners. We informed participants before completing the BDM measure that one of the 40 monetary amounts would be chosen at random and the transaction actually carried out at the end of the experiment. For example, if the experimenter randomly drew the amount 2.00 €, owners who

stated that they would rather keep the mug than receive 2.00 € would actually keep their mugs and receive no money; owners who stated that they would rather sell their mug would actually give their mugs back to the experimenter in exchange for 2.00 €. Similarly, nonowners who stated that they would rather receive the mug than 2.00 € would actually receive the mug, whereas nonowners who stated that they would rather receive 2.00 € would actually receive the money. Participants were also explicitly told that their reported preferences had no influence on the monetary amount that would be drawn at the end of the experiment and that it was thus in their best interest to report their true preferences.

After completing the BDM measure, participants responded to rating scales measuring the following: the dependent variable psychological ownership ("How much do you feel like you own the mug (even if you don't really own it)?" 1 = *not at all*, 7 = *absolutely*; adopted from Reb and Connolly, 2007); the control variable subjective information about the mug ("I have an adequate amount of information in order to evaluate the mug." 1 = *not at all*, 7 = *absolutely*); and 3) liking ("How much do you like the mug?" 1 = *not at all*, 7 = *extremely well*) as an exploratory variable.

Finally, the experimenter randomly chose one of the 40 monetary amounts. Depending on their reported preferences, participants then either kept or received a mug or were paid the cash amount.

2.1.2 Results

Eight participants reported intransitive preferences on the BDM measure and were thus excluded from analyses of this variable. All analyses were conducted using 2 (owners vs. nonowners) x 2 (touch vs. no-touch) between-subjects ANOVAs with the respective dependent variable.

We first tested our hypothesis that the ability to touch leads to greater psychological ownership regardless of participants' factual ownership status. Analyses indicated a small,

nonsignificant main effect of touch on psychological ownership, $F(1,136) = 1.93$, $p = .17$, $\eta_p^2 = .01$. Participants in the touch conditions reported similarly high levels of psychological ownership ($M = 2.30$, $SD = 1.65$) as participants in the no-touch conditions ($M = 2.67$, $SD = 1.76$). Thus, contrary to Hypothesis 1, touch does not systematically lead to greater psychological ownership in both owners and nonowners.

A closer look at the data indicated that touch and factual ownership interact to affect psychological ownership, $F(1,136) = 4.17$, $p = .04$, $\eta_p^2 = .03$, whereas the main effect of factual ownership is small to moderately large, $F(1, 136) = 3.44$, $p = .07$, $\eta_p^2 = .03$. As displayed in Figure 2.1, touch only leads to greater psychological ownership when participants actually own the mug; participants in the remaining three conditions reported similar, lower levels of psychological ownership. These findings contradict previous research showing that touch increases psychological ownership independent of factual ownership (Reb & Connolly, 2007) and that factual ownership leads to greater psychological ownership irrespective of touch (Peck & Shu, 2009).

We then tested our hypothesis that touch leads to higher valuations and found a large main effect, $F(1, 133) = 10.38$, $p < .01$, $\eta_p^2 = .07$. Participants who touched the mug attributed it greater value ($M = 3.68$, $SD = 1.39$) than participants who did not touch ($M = 2.79$, $SD = 1.39$). Thus, the data provide support for Hypothesis 2.

We also tested for the presence of an endowment effect and found a small to moderate effect of factual ownership on valuations, $F(1, 133) = 3.45$, $p = .07$, $\eta_p^2 = .03$. Owners tended to attribute the mug greater value ($M = 3.47$, $SD = 1.85$) than nonowners ($M = 2.97$, $SD = 1.46$). Thus, the data provide tentative support for Hypothesis 3.

Additional analyses indicate that factual ownership and touch did not interact to affect valuations, $F(1, 133) = .18$, $p = .68$, $\eta_p^2 < .01$ (see Figure 2.2 for mean valuations and

confidence intervals in each condition). Although this finding contradicts previous research showing that factual ownership only leads to greater valuations in the presence of touch (Reb & Connolly, 2007), it provides support for research indicating that both factual ownership and touch alone lead to greater valuations (Peck & Shu, 2009).

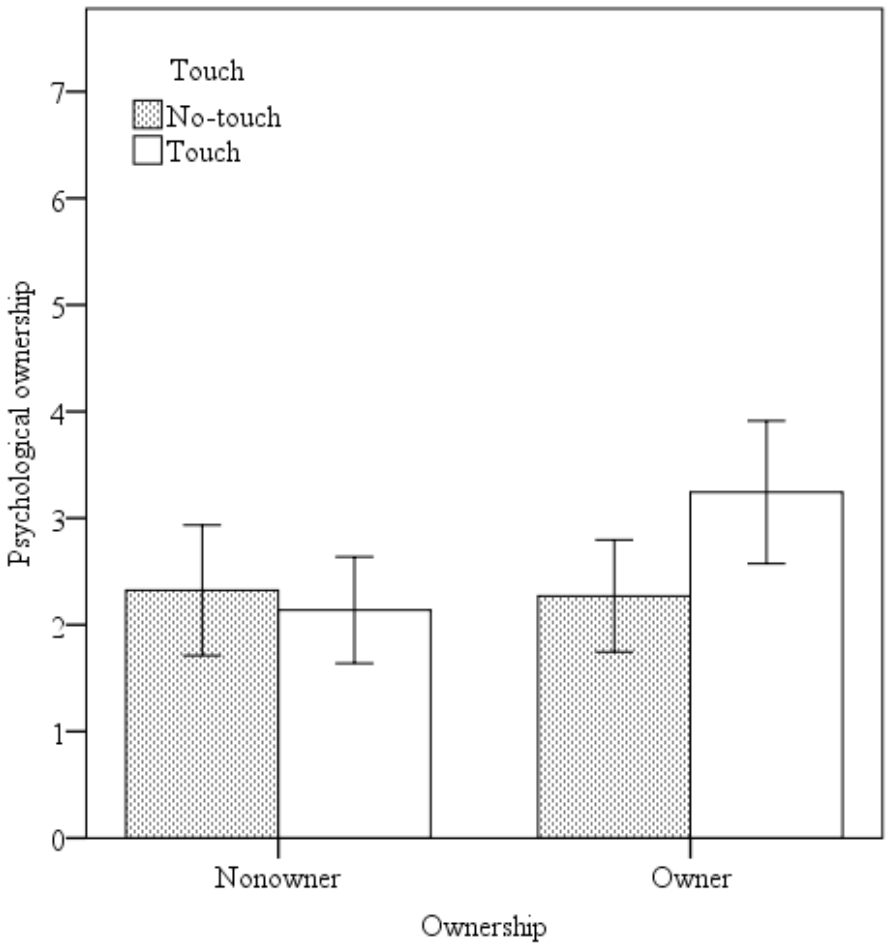

Figure 2.1 Mean psychological ownership according to condition. Error bars are 95% confidence intervals.

The results concerning valuations were partially supported by analyses of participants' reports of liking. Participants who touched the mug liked it more ($M = 4.86$, $SD = 1.22$) than those who did not ($M = 4.07$, $SD = 1.38$), $F(1, 137) = 12.65$, $p < .01$, $\eta_p^2 = .09$; whereas liking was similar for owners ($M = 4.31$, $SD = 1.44$) and nonowners ($M = 4.59$, $SD = 1.26$), $F(1,$

137) = 1.25, $p = .27$, $\eta_p^2 = .01$. The interaction effect was small and nonsignificant, $F(1, 137) = 1.12$, $p = .29$, $\eta_p^2 < .01$.

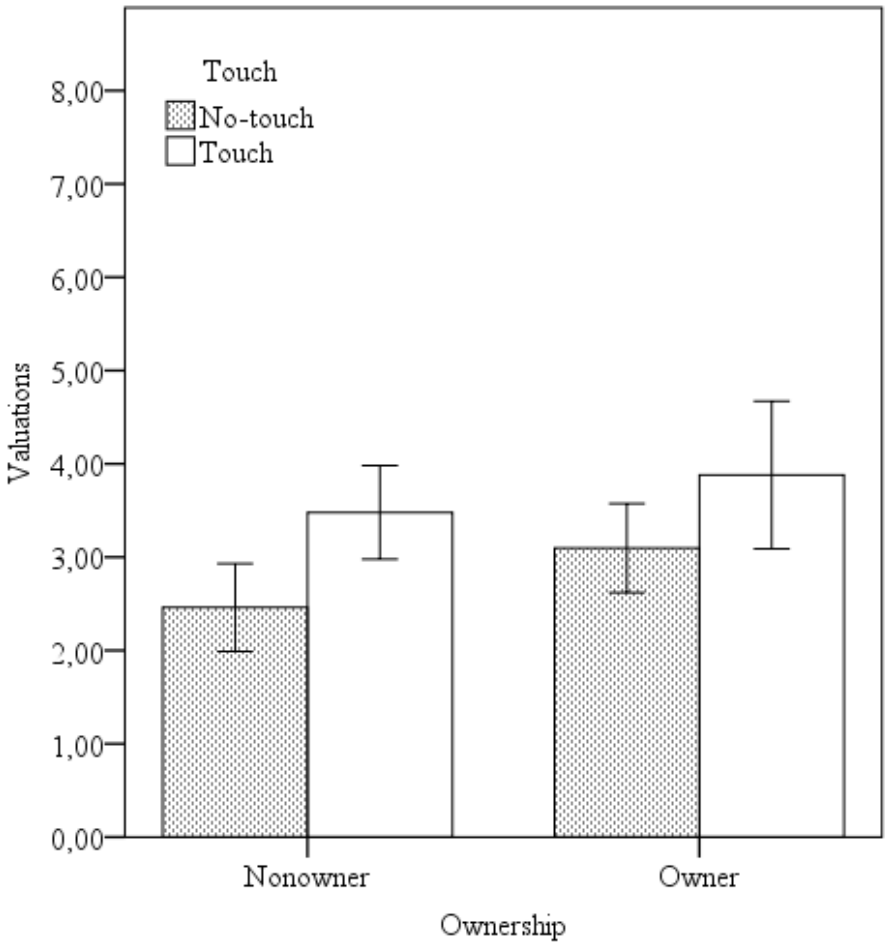

Figure 2.2 Mean valuations according to condition. Error bars are 95% confidence intervals.

Differences in psychological ownership and valuations between the conditions were not caused by differences in the amount of information on the mug that participants subjectively possessed—there was no main effect of factual ownership, $F(1, 136) = 2.29$, $p = .13$, $\eta_p^2 = .02$, and touch, $F(1, 136) = .05$, $p = .83$, $\eta_p^2 < .01$, and no interaction effect, $F(1, 136) = .70$, $p = .41$, $\eta_p^2 = .01$, on subjective information.

2.1.3 Discussion

In Experiment 1, we sought to answer the question whether factual ownership, psychological ownership, or both cause the endowment effect by manipulating psychological ownership through the ability to touch the good—a university coffee mug.

We found that touch increased psychological ownership only in participants who already owned the mug. Similarly, factual ownership led to greater psychological ownership only when participants had the opportunity to touch the mug. However, both factors led to greater valuations irrespective of the other. Thus, touch can lead to greater valuations without increasing psychological ownership. In addition, psychological ownership does appear to be necessary for factual ownership to cause an endowment effect.

These findings contradict previous research demonstrating that touch increases psychological ownership independent of factual ownership (cf., Peck & Shu, 2009; Reb & Connolly, 2007). One possible explanation for this may be that touch influences the effectiveness of the factual ownership manipulation. In this study, participants may have more readily believed the ownership manipulation when given the opportunity to touch the good; owners who could not touch may not have believed that the good was truly theirs to keep. In previous studies, it is possible that participants who were given the opportunity to touch simply believed that the good was theirs regardless of what the experimenter told them. That is, touch may simply influence participants' understanding of the factual ownership manipulation rather than affect psychological ownership per se.

Our data also suggest that touch may lead to greater valuations by causing participants to like the object more than participants who did not have the opportunity to touch. This explanation is in line with research showing that touch leads to positive appraisal (Peck & Wiggins, 2006).

However, there are two methodological weaknesses in Experiment 1 that might have lead to the surprising results. First, differences in touch frequency and duration between

owners and non-owners may have mediated the effect of touch on psychological ownership. We did not control whether participants in the touch conditions actually touched the mug before continuing with the questionnaire, nor did we assess the amount of time spent touching. It is possible that owners, having just read that they now own the mug in front of them, were motivated to inspect their new endowment and were thus more likely to touch the mug or touch it longer than nonowners. This may account for the absence of the expected positive effect of touch on psychological ownership in the nonowner condition.

Second, it is possible that that differences in valuations between participants in the touch and no-touch conditions were caused by exposure effects, as greater exposure has been shown to cause higher valuations (e.g., Zajonc, 1968). Only particpants in the touch condition were exposed to the mug for the entire duration of the experiment—participants in the no-touch conditions only saw the mug briefly before being seated at their cubicles. In order to address these methodological weaknesses, we conducted a second replication in Experiment 2.

2.2 Experiment 2

In Experiment 2, we once again examined the roles of factual and psychological ownership in the endowment effect while by manipulating the latter through the ability to touch. In doing so, we held exposure times constant across all groups and ensured that the duration of touch was consistent for both owners and nonowners.

As an additional, exploratory condition, we also varied the number of times that participants touched the mug (one vs. three times). In endowment effect experiments that do not control for the number of times that participants touch the good, it is possible that some participants touch only once, while others touch the good multiple times. Whereas theories of psychological ownership would predict an increase in psychological ownership when participants touch the good more often (Pierce et al., 2003) and thus greater valuations,

findings regarding the effect of exposure would predict the opposite in some cases, such as when the good is low in complexity (cf., Bornstein, 1989). Thus, we sought to determine whether it is necessary to control for the number of times that participants actually touch the good when they are provided the opportunity to do so. If so, this may account for the disparity between the findings in Experiment 1 and previous studies.

We expected participants to report greater psychological ownership when they have the ability to touch the good, as well as greater psychological ownership when they touch the good more often, regardless of whether they actually own it (Hypothesis 1). We also expected factual ownership (Hypothesis 2) and the ability to touch to lead to greater valuations, the latter even more so when participants touched the good multiple times (Hypothesis 3). However, as in Experiment 1, we had no prior expectations regarding the effect of factual ownership on psychological ownership as well as the interaction between factual ownership and touch.

2.2.1 Method

Participants and design. Participants were 165 individuals from a psychology participant pool at the University of Erfurt, who participated in exchange for either cash (on average approximately 4.00 €) or a University of Erfurt coffee mug, depending on transaction outcomes. The mean age was 22.01 years (*SD* = 3.27). 138 participants were female. The experiment had a 2 (factual ownership: owners vs. nonowners) x 3 (psychological ownership: touch vs. multiple-touch vs. no-touch) between-subjects design. Participants were randomly assigned to one of the six conditions, which were run simultaneously. Each session included a maximum of 16 participants and lasted approximately 15 minutes.

Procedure and materials. Experiment 2 followed the same procedure as used in Experiment 1 with the exception of the following modifications.

Upon being seated, participants in all experimental conditions found a mug on the table in their cubicle with a note stating that they were not to touch the mug until explicitly told to do so by the experimenter. In the no-touch conditions, the mug was additionally placed under a clear glass cover. This prevented participants from touching the mug while still allowing for equal durations of exposure across all experimental conditions. No participants attempted to lift the glass cover or touch the mug when not explicitly told to do so.

Written instructions were used to implement the experimental manipulations of factual ownership and touch. Participants first viewed a system-paced computer presentation in which they were informed of their factual ownership status and then asked to either touch (touch conditions) or visually inspect (no-touch conditions) the mug until the screen flashed (after 30 seconds in the touch and no-touch conditions; after 10 seconds in the multiple touch condition). After the screen flashed, participants were asked to place the mug on the table and not touch it again until asked to do so (touch conditions) or direct their attention back to the computer screen (no-touch). Participants then completed either nine (touch and no-touch conditions) or three (multiple-touch condition) unrelated filler items (e.g., judging which of two lines is longer). This procedure was repeated for participants in the multiple-touch condition an additional two times. In this way, all participants either touched or visually inspected the mug for a total of 30 seconds. Participants then completed the same items as in Experiment 1 as well as three additional psychological ownership items adopted from Peck and Shu (2009): “I feel like this is my mug.”; “I feel like I own this mug.”; “I feel a high degree of personal ownership of this mug.”

2.2.2 Results

Seventeen participants reported intransitive preferences on the BDM measure and were thus excluded from analyses of this variable. All analyses were conducted using 2 (owners vs. nonowners) x 3 (touch vs. multiple-touch vs. no-touch) between-subjects

ANOVAs with the respective dependent variable. We computed a psychological ownership value for each participant as the average of their responses to the four psychological ownership items (Cronbach's alpha = .94).

We first tested our hypothesis that participants in the multiple-touch condition would report the highest levels of psychological ownership, followed by participants in the touch condition and, finally, those in the no-touch condition.

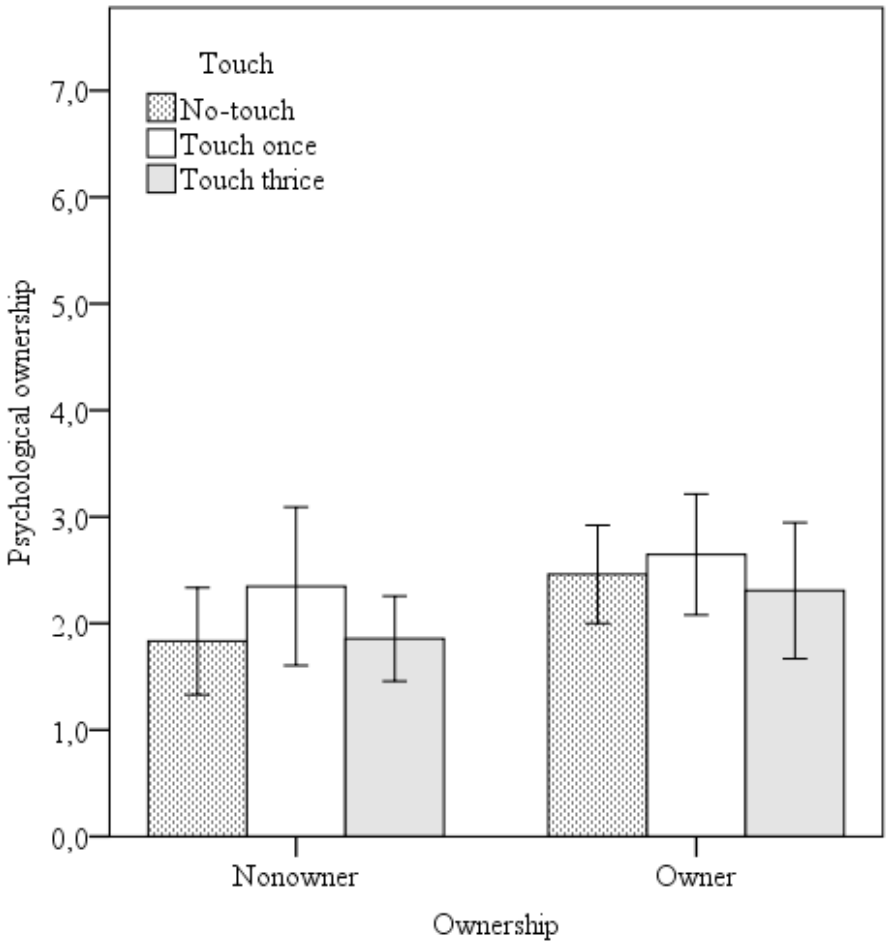

Figure 2.3 Mean psychological ownership according to condition. Error bars are 95% confidence intervals.

There was a small, nonsignificant effect of touch condition on psychological ownership, $F(2, 158) = 1.35$, $p = .26$, $\eta_p^2 = .02$. That is, there were no significant differences in levels of psychological ownership between participants in the multiple-touch ($M = 2.07$, $SD = 1.33$), touch ($M = 2.51$, $SD = 1.59$), and no-touch conditions ($M = 2.17$, $SD = 1.29$). There was also

no interaction between touch and factual ownership, $F(2, 158) = .19$, $p = .83$, $\eta_p^2 < .01$. Thus, we found no support for Hypothesis 1 (means and confidence intervals for all conditions are displayed in Figure 2.3). Factual ownership, however, did have a small to moderately large effect on psychological ownership, $F(1, 158) = 4.39$, $p = .04$, $\eta_p^2 = .03$. Owners reported significantly higher levels of psychological ownership ($M = 2.48$, $SD = 1.43$) than nonowners ($M = 2.00$, $SD = 1.35$).

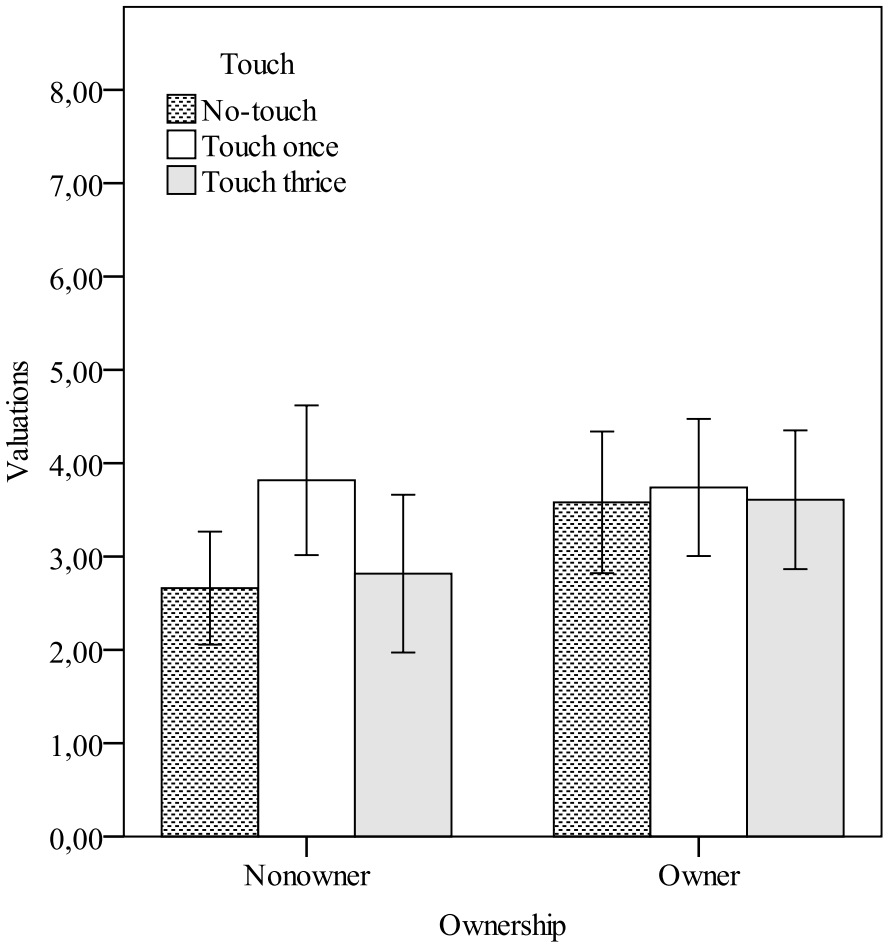

Figure 2.4 Mean valuations according to condition. Error bars are 95% confidence intervals.

We then tested our hypotheses that factual ownership and the ability to touch would lead to greater valuations. Participants' valuations were not affected by the ability to touch, $F(2, 142) = 1.77$, $p = .17$, $\eta_p^2 = .02$ (see Figure 2.4 for means and confidence intervals in all conditions). Valuations in the multiple-touch ($M = 3.21$, $SD = 1.91$), touch ($M = 3.78$, $SD =$

1.71) and no-touch conditions (M = 3.16, SD = 1.87) were similar. Factual ownership had a small to moderately large, near significant effect on participants' valuations, $F(1, 142) = 3.25$, $p = .07$, $\eta_p^2 = .02$. Owners tended to attribute the mug greater value (M = 3.63, SD = 1.83) than nonowners (M = 3.08, SD = 1.84). The interaction effect was nonsignificant, $F(2, 142) = 1.02$, $p = .36$, $\eta_p^2 = .01$. Thus, we found tentative support for Hypothesis 2—that factual ownership will lead to an endowment effect. Hypothesis 3, however, was not supported—the ability to touch had no effect on participants' valuations.

Analyses of participants' liking indicate a near significant effect of the ability to touch on participant liking, $F(2, 158) = 2.60$, $p = .08$, $\eta_p^2 = .03$. Liking was highest in the no-touch condition (M = 4.40, SD = 1.47), slightly lower in the touch condition (M = 4.31, SD = 1.41) and lowest in the multiple-touch condition (M = 3.80, SD = 1.53). There was no effect of factual ownership, $F(1, 158) < .01$, $p = .98$, $\eta_p^2 < .01$, and no interaction effect, $F(2, 158) = .27$, $p = .77$, $\eta_p^2 < .01$.

There were no differences in the amount of information that participants felt they had on the mug due to touch, $F(2, 158) < .01$, $p = .99$, $\eta_p^2 < .01$, factual ownership, $F(1, 158) = .22$, $p = .64$, $\eta_p^2 < .01$, or their interaction, $F(2, 158) = .17$, $p = .85$, $\eta_p^2 < .01$.

2.2.3 Discussion

In Experiment 2, we once again addressed the question whether factual ownership, psychological ownership, or both cause the endowment effect. We again manipulated psychological ownership through the ability to touch a university coffee mug. The procedure used in Experiment 1 did not rule out a possible confounding effect of exposure nor ensured that participants in the touch condition actually touched the mug. Thus, we modified the procedure used in Experiment 2 to control for these possible explanations for the disparities between the findings of Experiment 1 and previous research. In addition, we explored the

possibility that the number of times participants touch the good may influence the effect of touch on psychological ownership and valuations.

We found that touch had no influence on psychological ownership, regardless of whether participants touched the mug once for thirty seconds or three times for ten seconds. This finding is in direct contrast to previous research, in which touch lead to greater psychological ownership either in both owners and nonowners (e.g., Reb & Connolly, 2007; Peck & Shu, 2009) or in owners only (Experiment 1). We also failed to replicate the findings of Experiment 1 that the ability to touch leads to greater valuations.

However, we found that factual ownership significantly increases psychological ownership regardless of whether participants touched the mug as well as a trend for an endowment effect. These findings confirm previous research (e.g., Peck & Shu, 2009) and add support to the idea that the findings of Experiment 1—that factual ownership only lead to greater psychological ownership when participants also touched the mug—may indeed have been due to the manipulation of factual ownership being less convincing for participants in the no-touch condition.

Because exposure was held constant across touch conditions in this experiment, it is possible that the findings regarding the effect of touch on valuations in Experiment 1 were indeed due to an inadvertent exposure effect, as participants in the touch condition were exposed to the mug for a longer period of time than participants in the no-touch condition.

The findings of Experiment 2, however, do not indicate that the absence of the expected effect of touch on psychological ownership for nonowners in Experiment 1 was due to nonowners not actually touching the mug—in Experiment 2, we also failed to find this effect despite ensuring that all participants in the touch conditions actually touched the mug. Thus, we found no support for previous studies that touch leads to psychological ownership (e.g., Reb & Connolly, 2007; Peck & Shu, 2009).

Overall, due to conflicting findings regarding the effect of touch on psychological ownership as well as possible confounding variables such as liking, touch does not appear to be an ideal means to study the role of psychological ownership in the endowment effect. Therefore, in Experiment 2 we used an alternative manipulation of psychological ownership to examine the roles of factual and psychological ownership in endowment effect research.

2.3 Experiment 3

In Experiment 3, we manipulated ownership in a manner more similar to everyday ownership experiences in order to minimize confounding variables not typically associated with factual and psychological ownership. We assigned participants to conditions of factual ownership (owners), psychological ownership (borrowers), or no-ownership (nonowners). Owners received a University of Erfurt mug, while borrowers were given the opportunity to borrow a mug supposedly belonging to the University of Erfurt. Nonowners were simply told that they could decide between receiving a mug or cash. We hypothesized that owners would report the highest levels of psychological ownership, followed by borrowers and then nonowners (Hypothesis 1). We tested two competing hypotheses regarding valuations. If factual ownership is necessary to cause the endowment effect, valuations should be highest in the owner condition and equally low in the borrower and nonowner conditions (Hypothesis 2a). However, if psychological ownership also causes the endowment effect, valuations should be highest in the owner condition, lowest in the nonowner condition, and relatively moderate in the borrower condition (Hypothesis 2b).

2.3.1 Method

Participants and design. Participants were 103 individuals from a psychology participant pool at the University of Erfurt, who participated in exchange for either cash (on average approximately 4.00 €) or a University of Erfurt coffee mug, depending on transaction outcomes. Mean age was 22.69 years (*SD* = 3.57). Eighty participants were female. The

experiment had a 3 (ownership: owners vs. borrowers vs. nonowners) single-factor design. Participants were randomly assigned to one of the three conditions, which were run simultaneously. Each session included a maximum of 16 participants and lasted approximately 15 minutes.

Procedure and materials. Upon entering the psychology lab, participants were seated in individual cubicles containing a questionnaire with instructions and two identical University of Erfurt coffee mugs. The mugs were positioned under a glass cover to prevent possible confounding effects related to touch.

In the owner and nonowner conditions, the bottom of one mug was adorned with a sticker displaying the mug's supposedly unique serial number. In the borrower condition, the sticker displayed the mug's inventory number supposedly assigned by the University of Erfurt.[1] We chose to place the sticker on the bottom of the mug to minimize possible reductions in subjective value due to the presence of the sticker—i.e. borrowers may have believed that they were not allowed to remove the sticker later, which may have made the mug appear less valuable if the sticker were highly visible. The mug with the sticker was placed on its side with the bottom facing the participant to ensure that the sticker was clearly visible during the experiment. The second mug stood next to the first and served as an example, allowing participants to easily obtain an impression of what the mug with the sticker looked like.

Participants first read the instructions in which they were informed of their ownership status (see Appendix B for original instructions). Owners were told that the mug with the serial number was theirs to keep. Borrowers were told that the mug with the inventory number

[1]At the University of Erfurt, all furnishings and equipment are assigned unique inventory numbers that are visible in everyday use. Thus, participants were familiar with the idea that such inventory numbers indicate that the object is university property.

was university property, but that they could borrow the mug for an indefinite period of time. Nonowners were told that they would have the opportunity to choose between receiving the mug with the serial number or cash. In order to increase the realness of the ownership manipulation, we then asked participants to sign either a confirmation of receipt form (owners), a borrower's contract (borrowers), or a form in which participants confirmed that they understood that the mug with the serial number was not theirs (nonowners). See Appendix B for all three forms. Participants then read similar instructions and completed identical measures to those used in Experiment 1 in addition to the psychological ownership items used in Experiment 2 (see Appendix B for original instructions and questionnaire).

2.3.2 Results

Five participants reported intransitive preferences on the BDM measure and were thus excluded from analyses of this variable. All analyses were run using one-factorial 3 (owner vs. borrower vs. nonowner) between-subjects ANOVAs. We computed a psychological ownership value for each participant as the average of their responses to the four psychological ownership items (Cronbach's alpha = .95).

We first tested our hypothesis that psychological ownership would be highest for owners, followed by borrowers and then nonowners. There was a large effect of ownership condition on psychological ownership, $F(1, 100) = 12.76$, $p < .01$, $\eta_p^2 = .20$. As expected, owners reported the highest levels of psychological ownership ($M = 3.21$, $SD = 1.65$), followed by borrowers ($M = 2.30$, $SD = 1.33$) and then nonowners ($M = 1.54$, $SD = 1.02$). Thus, our data provide support for Hypothesis 1. See Figure 2.5 for means and confidence intervals in each condition.

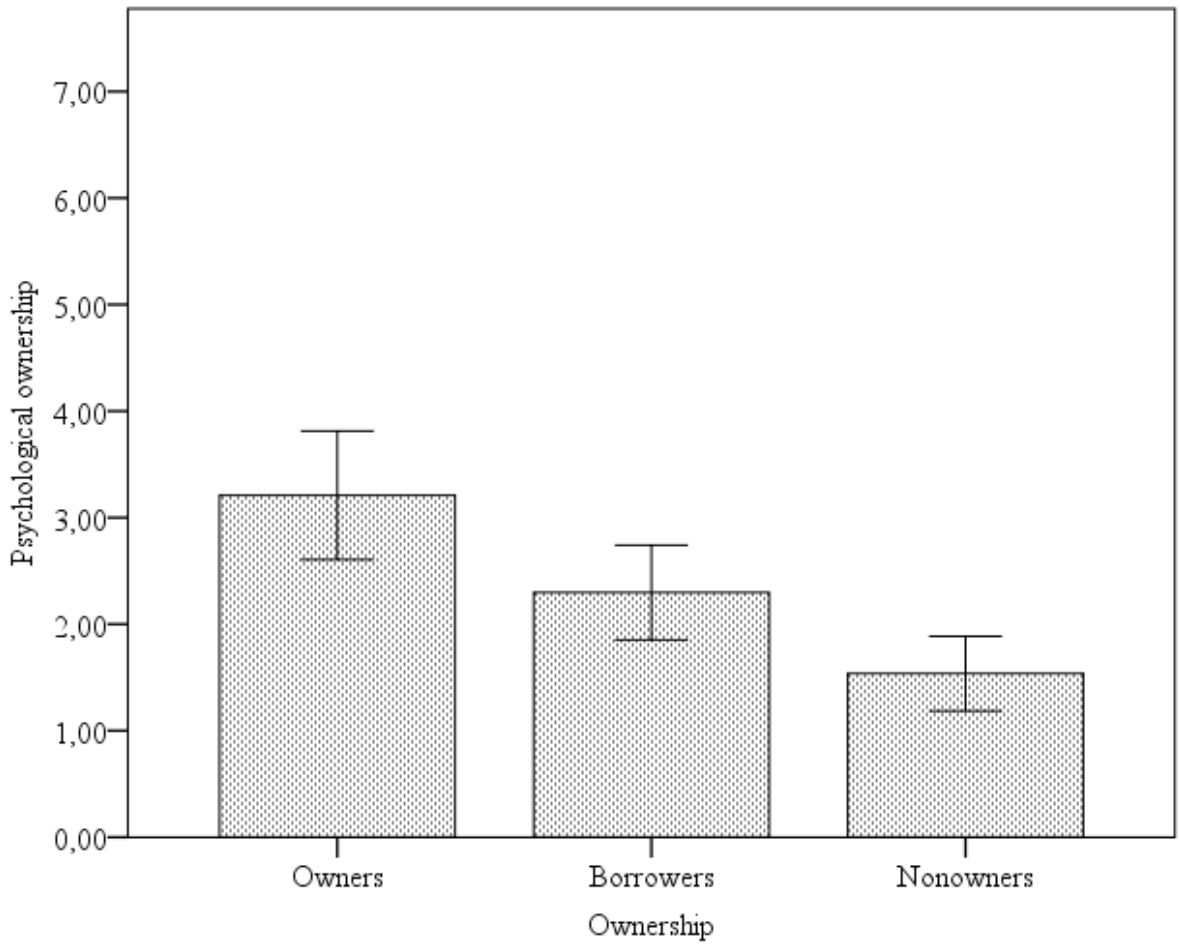

Figure 2.5 Mean psychological ownership scores according to condition. Error bars are 95% confidence intervals

We then tested our competing hypotheses regarding the role of ownership on valuations and found a moderately large effect of ownership condition, $F(1, 95) = 3.13$, $p = .05$, $\eta_p^2 = .06$. As displayed in Figure 2.6, owners had the highest valuations ($M = 3.62$, $SD = 1.73$), while borrowers ($M = 2.76$, $SD = 1.26$) and nonowners ($M = 2.64$, $SD = 2.00$) had similar, lower valuations. Thus, the data support Hypothesis 2a and not Hypothesis 2b—factual ownership appears to be necessary to cause the endowment effect, while psychological ownership alone is not a sufficient condition. See Figure 2.6 for means and confidence intervals in each condition.

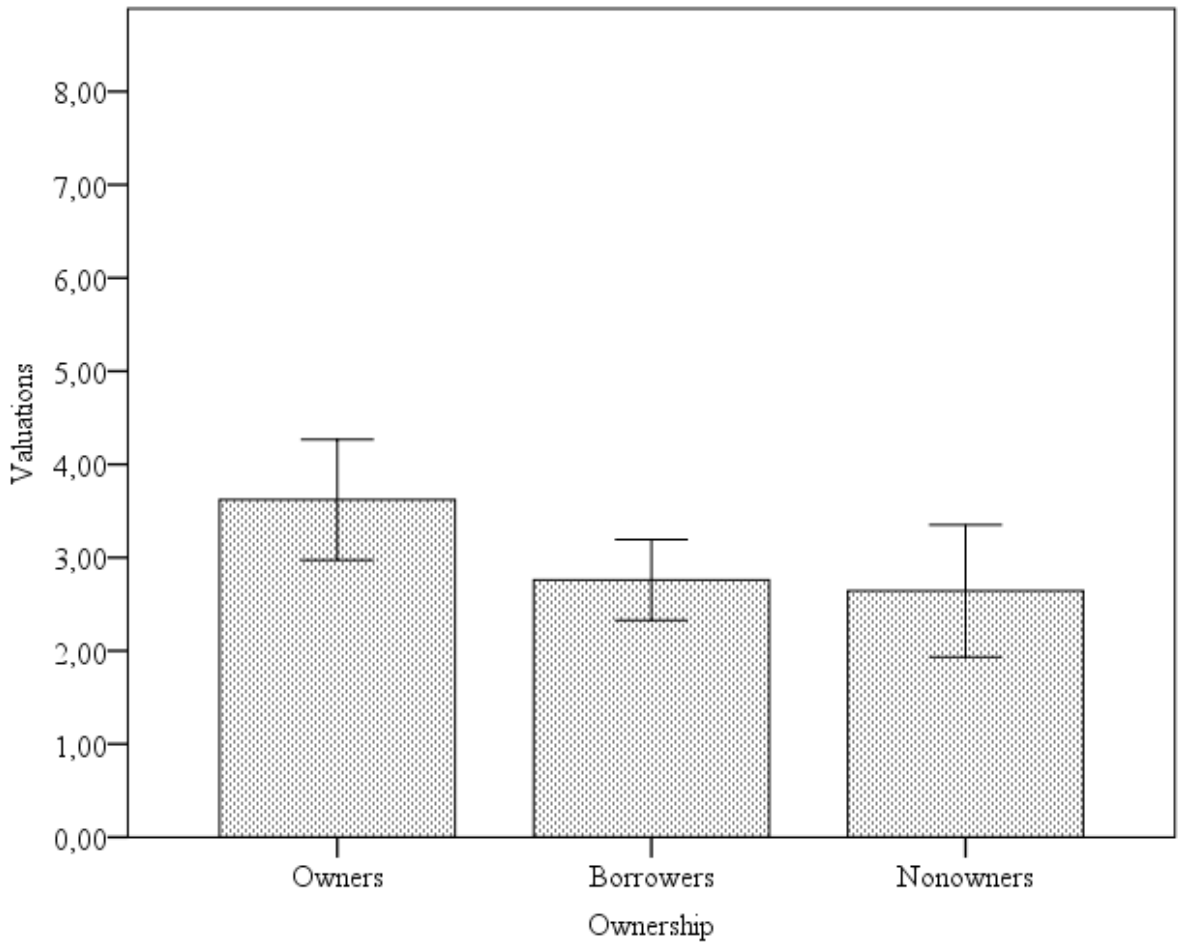

Figure 2.6 Mean valuations according to condition. Error bars are 95% confidence intervals.

The differences in psychological ownership and valuations between owners, borrowers, and nonowners were likely not due to differences in liking or information regarding the mug. There were small, nonsignificant effects of ownership condition on participants' responses to the liking, $F(1, 103) = .90$, $p = .41$, $\eta_p^2 = .02$, and subjective information items, $F(1, 103) = .65$, $p = .52$, $\eta_p^2 = .01$.

2.4 Discussion

In this paper, we sought to answer the question whether factual ownership, psychological ownership, or both cause the endowment effect. In two replication studies, we manipulated factual ownership by giving half of participants a university coffee mug and psychological ownership by allowing half of participants to touch the mug. Touch only led to

greater psychological ownership in participants who owned the mug in Experiment 1 and had no effect on psychological ownership in Experiment 2. Although the opportunity to touch resulted in greater valuations in both owners and nonowners in Experiment 1, it again had no effect on participants' valuations in Experiment 2. Thus, it appears that in situations where touch does have an effect on participants' valuations, it is not due to psychological ownership as assumed by previous studies (cf., Peck & Shu, 2009; Reb & Connolly, 2007). Overall, it appears that confounding variables such as exposure effects or increased liking through touch may play an important role.

We also found that factual ownership increases both psychological ownership and individuals' valuations even when psychological ownership is not concurrently high. There was evidence, however, that the ability to touch a good may make manipulations of factual ownership more convincing. Still, psychological ownership does not appear to be necessary for the endowment effect to occur.

To further examine the roles of factual and psychological ownership while avoiding confounding variables that possibly stem from the touch manipulation, we conducted a third experiment in which we manipulated psychological ownership in a manner more similar to everyday ownership experiences. We divided participants into owners, borrowers, and nonowners and found, as expected, that owners reported the highest, nonowners the lowest, and borrowers comparatively moderate levels of psychological ownership. Although we found the expected endowment effect between owners and nonowners, the increased psychological ownership observed in borrowers as compared to nonowners did not result in greater valuations in the former. Thus, factual ownership appears to be necessary for the endowment effect to occur, while psychological ownership does not appear to be a sufficient condition of the effect.

Overall, the findings indicate that the endowment effect is caused by factual and not psychological ownership. Thus, the current definition of the endowment effect as being

caused by factual ownership appears to be accurate. Our findings also show that touch may not influence psychological ownership exactly as assumed in previous research as well as that manipulations closer to everyday ownership experiences may be more effective. Still, psychological ownership and touch are relevant factors to consider when conducting endowment effect research. Measures of psychological ownership, for example, may be useful as a means to ensure that the manipulation of factual ownership was successful.

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2.6 Appendix A

English translation of written instructions and questionnaire used in Experiment 1 (originals were in German).

- Page 1 -

[OWNER] You now own a coffee mug identical to the one that the experimenter just showed you. After the experiment you may take the mug home with you.
In a minute, you will have the opportunity to decide whether you would like to keep your mug or trade it for cash.

[NONOWNER] The coffee mug that the experimenter just showed you does not belong to you.
However, in a minute you will have the opportunity to decide whether you would rather receive the mug or cash.

[ALL] Demographic items

- Page 2 -

[OWNER] Please read the following instructions very carefully:
You now have the opportunity to sell your mug for cash. Below, you will see a series of choices between "Keep mug / Sell mug for ___€". The cash amounts are between 20 cents and 8.00 €.
If, for example, you would rather keep your mug than sell it for a certain cash amount, your answer should look like this:

1. Keep mug / ~~Sell mug for ___€~~

But if you would rather sell your mug, your answer should look like this:

1. ~~Keep mug~~ / Sell mug for ___€

At the end of the experiment, one of the cash amounts will be drawn at random. If you answered that you would rather keep your mug than receive the randomly chosen amount, you may take your mug home and keep it. If you answered that you would rather sell your mug for the randomly chosen amount, you must give your mug back to the experimenter and then immediately receive the cash amount.

Please keep in mind that your answers have no influence on the cash amount that is ultimately drawn—that is determined by chance alone. Therefore, it is in your best interest to provide answers that correspond to what your mug is really worth to you.

[NONOWNER] Please read the following instructions very carefully:

You now have the opportunity to decide between receiving a mug or cash. Below, you will see a series of choices between "Receive mug / Receive ___€". The cash amounts vary between 20 cents and 8.00 €.

If, for example, you would rather receive the mug than receive the cash amount, your answer should look like this:

1. Receive mug / ~~Receive ___€~~

But if you would rather receive the cash amount, your answer should look like this:

1. ~~Receive mug~~ / Receive ___€

At the end of the experiment, one of the cash amounts will be drawn at random. If you answered that you would rather receive the mug than receive the randomly chosen amount, you will get a mug that you can take home and keep. If you answered that you would rather receive the cash amount, then you immediately receive the cash amount.

Please keep in mind that your answers have no influence on the cash amount that is ultimately drawn—that is determined by chance alone. Therefore, it is in your best interest to provide answers that correspond to what the mug is really worth to you.

- Page 3 -

[OWNER] The following two questions are to make sure that you have understood the instructions.

You would like to sell your mug, what do you cross out?

Keep mug / Sell mug for ___€

You would like to keep your mug, what do you cross out?

Keep mug / Sell mug for ___€

On the next pages, the choices for the cash amounts between 20 cents and 8.00 € are listed. Your task is to cross out the option that you do not want for each of the 40 choices.

[NONOWNER] The following two questions are to make sure that you have understood the instructions.

You would like to receive the cash, what do you cross out?

Receive mug / Receive ___€

You would like to receive the mug, what do you cross out?

Receive mug / Receive ___€

On the next pages, the choices for the cash amounts between 20 cents and 8.00 € are listed. Your task is to cross out the option that you do not want for each of the 40 choices.

- Page 4/5 -

[OWNER] 1. Keep mug / Sell mug for .20 € … 40. Keep mug / Sell mug for 8.00 €

[NONOWNER] 1. Receive mug / Receive .20 €" … 40. Receive mug / Receive 8.00 €"

- Page 6 -

[ALL] Liking item, information item, psychological ownership item

2.7 Appendix B

English translation of written instructions and questionnaire used in Experiment 2 (originals were in German).

- Page 1 -

[OWNER] There are two new University of Erfurt coffee mugs sitting in front of you. The mug with the serial number _____ is now yours. After you have read and signed the confirmation of receipt form on the next page, you may take the mug home and keep it.
Please fill out and sign the confirmation of receipt form on the next page before continuing with the questionnaire. In order to ensure that your answers remain anonymous, we will separate the form from the rest of your questionnaire and store it separately.

[BORROWER] There are two new University of Erfurt coffee mugs sitting in front of you. Both mugs are property of the University of Erfurt. However, you may borrow the mug with the inventory number _____. After you have read and signed the borrower's contract on the next page, you may take the mug home for an indefinite period of time. However, the mug will remain property of the University of Erfurt.
Please fill out and sign the borrower's contract on the next page before continuing with the questionnaire. In order to ensure that your answers remain anonymous, we will separate the form from the rest of your questionnaire and store it separately.

[NONOWNER] There are two new University of Erfurt coffee mugs sitting in front of you. After you have read and signed the form on the next page, you will have the opportunity to decide whether you would rather receive the mug with the serial number _____ or cash.
Please fill out and sign the form on the next page before continuing with the questionnaire. In order to ensure that your answers remain anonymous, we will separate the form from the rest of your questionnaire and store it separately.

[OWNER]

Confirmation of Receipt Form

I, _____, confirm that I have received the mug with the serial
Participant's name
number _____. I understand that I may take the mug home and keep it.

_____

City, Date Participant's signature

[BORROWER]

Borrower's Contract

I, _____, confirm that I have received the mug with the serial
Participant's name
number _____. I understand that the mug remains property of the University of Erfurt, and that I may take it home and use it for an indefinite period of time.

_____

City, Date Participant's signature

[NONOWNER]

Form

I, _____, confirm that I understand that the mug with the serial
Participant's name
number _____ is not my property. I understand that I will have the opportunity to decide whether I receive the mug or cash during this study.

_____

City, Date Participant's signature

[OWNER] Please read the following instructions very carefully:

In a minute, you will have the opportunity to sell your mug for cash. Below, you will see a series of choices between "Keep mug / Sell mug for ___€". The cash amounts are between 20 cents and 8.00 €.

If, for example, you would rather keep your mug than sell it for a certain cash amount, your answer should look like this:

1. Keep mug / ~~Sell mug for ___€~~

But if you would rather sell your mug, your answer should look like this:

1. ~~Keep mug~~ / Sell mug for ___€

At the end of the experiment, one of the cash amounts will be drawn at random. If you answered that you would rather keep your mug than receive the randomly chosen amount, you may take your mug home and keep it. If you answered that you would rather sell your mug for the randomly chosen amount, you must give your mug back to the experimenter and will then immediately receive the cash amount.

Please keep in mind that your answers have no influence on the cash amount that is ultimately drawn—that is determined by chance alone. Therefore, it is in your best interest to provide answers that correspond to what your mug is really worth to you.

[BORROWER] Please read the following instructions very carefully:

In a minute, you will have the opportunity to exchange the mug with the inventory number ____ for cash. Below, you will see a series of choices between "Take mug / receive ___€". The cash amounts are between 20 cents and 8.00 €.

If, for example, you would rather take the mug than receive the cash amount, your answer should look like this:

1. Take mug / ~~Receive ___€~~

But if you would rather exchange the mug for the cash, your answer should look like this:

1. ~~Take mug~~ / Receive ___€

At the end of the experiment, one of the cash amounts will be drawn at random. If you answered that you would rather take the mug than receive the randomly chosen amount, you

may take the mug with the inventory number _____ home and keep it. If you answered that you would rather receive the cash amount, then you immediately receive the cash amount.

Please keep in mind that your answers have no influence on the cash amount that is ultimately drawn—that is determined by chance alone. Therefore, it is in your best interest to provide answers that correspond to what your mug is really worth to you.

[NONOWNER] Please read the following instructions very carefully:

In a minute, you will have the opportunity to decide between receiving the mug with the serial number _____ or cash. Below, you will see a series of choices between "Receive mug / Receive ___€". The cash amounts vary between 20 cents and 8.00 €.

If, for example, you would rather receive the mug than the cash amount, your answer should look like this:

1. Receive mug / ~~Receive ___€~~

But if you would rather receive the cash amount, your answer should look like this:

1. ~~Receive mug~~ / Receive ___€

At the end of the experiment, one of the cash amounts will be drawn at random. If you answered that you would rather receive the mug than receive the randomly chosen amount, you may take the mug with the serial number _____ home and keep it. If you answered that you would rather receive the cash amount, then you immediately receive the cash amount.

Please keep in mind that your answers have no influence on the cash amount that is ultimately drawn—that is determined by chance alone. Therefore, it is in your best interest to provide answers that correspond to what your mug is really worth to you.

[OWNER] The following two questions are to make sure that you have understood the instructions.

You would like to sell your mug, what do you cross out?

Keep mug / Sell mug for ___€

You would like to keep your mug, what do you cross out?

Keep mug / Sell mug for ___€

On the next pages, the choices for the cash amounts between 20 cents and 8.00 € are listed.

Your task is to cross out the option that you do not want for each of the 40 choices.

[BORROWER] The following two questions are to make sure that you have understood the instructions.

You would like to receive the cash, what do you cross out?

Take mug / Receive ___€

You would like to take the mug, what do you cross out?

Take mug / Receive ___€

On the next pages, the choices for the cash amounts between 20 cents and 8.00 € are listed.

Your task is to cross out the option that you do not want for each of the 40 choices.

[NONOWNER] The following two questions are to make sure that you have understood the instructions.

You would like to receive the cash, what do you cross out?

Receive mug / Receive ___€

You would like to receive the mug, what do you cross out?

Receive mug / Receive ___€

On the next pages, the choices for the cash amounts between 20 cents and 8.00 € are listed.

Your task is to cross out the option that you do not want for each of the 40 choices.

[OWNER] 1. Keep mug / Sell mug for .20 € … 40. Keep mug / Sell mug for 8.00 €

[BORROWER] 1. Take mug / Receive .20 € … 40. Take mug / Receive 8.00 €

[NONOWNER] 1. Receive mug / Receive .20 €" … 40. Receive mug / Receive 8.00 €"

- Page 7 -

[OWNER] The following questions refer to your mug.

[BORROWER] The following questions refer to the mug with the inventory number ____.

[NONOWNER] The following questions refer to the mug with the serial number ____.

[ALL] Psychological ownership items

- Page 8 -

[ALL] Liking item, information item, demographic items

3. Study 2

Towards a new measure of the endowment effect in children

Examining the endowment effect in children may help us better understand its origin. That is, if children exhibit an endowment effect of similar magnitude as adults, it is possible that the effect is a stable characteristic of human judgment rather than a behavior that is highly dependent on trading experience, as children and adults differ substantially in terms of the amount of trading experience they possess. The few studies to date that examined child samples found evidence of an endowment effect (Harbaugh, Krause, & Vesterlund (2001) in kindergarteners, third-graders and fifth-graders; and Lucas, Wagner, & Chow (2008) in four and five-year-olds), thus adding to a growing body of research showing that children demonstrate many of the same judgment and decision making biases as adults (cf., Davidson, 1995, for conjunction fallacy; Schlottman & Tring, 2005, for framing effect). However, there are no studies on the endowment effect in children that use measures similar to those considered standard in adult research (e.g., BDM measure discussed in Study 1). Nor has such a study held confounding variables constant that may increase the subjective value of the good—such as differences in touch (Reb & Connolly, 2007) and exposure (Pierce, Kostova, & Dirks, 2003) between owners and nonowners.

All studies to date applied a dichotomous choice measure of the endowment effect first used by Knetsch (1989). With this measure, participants are given one of two items (e.g., key chain vs. rubber ball) and are then asked whether they would rather keep their endowment or exchange it for the alternative. If children endowed with an item prefer it more often than children not endowed with that item, or if children trade less often than would be expected based on chance alone, this is taken as evidence of an endowment effect.

A shortcoming of this method is that it is difficult to select item-pairs in which participants view both items to be equally desirable. Indeed, both Harbaugh et al. (2001) and

Lucas et al. (2008) encountered this issue in their studies. This problem is compounded when comparing the effect across different age-groups, as the desirability of item-pairs certainly differs according to participant age, especially when age differences are large.

To remedy this issue, researchers have since developed superior methods for examining the endowment effect in adult samples. Indeed, a meta-analysis on endowment effect research from the past thirty years indicated that the measures of value judgments used most often in studies with adult subjects do not include the dichotomous choice measure that is, to date, used exclusively in studies on the endowment effect in children. If children are susceptible to the endowment effect, we should also find differences in valuations between owners and nonowners when using procedures considered standard in studies on adults.

The purpose of the current study was, therefore, to develop a measure of the endowment effect—which we will call *preference-cards*—that is structurally identical to the BDM measure typically used in adult samples (e.g., Carmon, Wertenbroch, & Zeelenberg, 2003; Kahneman, Knetsch, & Thaler, 1990; Strahilevitz & Loewenstein, 1998) but with a scenario that is applicable to a broad age range. We then sought to build on the first findings of the endowment effect in children by using this method in a sample of primary school children while holding touch and exposure to the good constant between owners and nonowners. Finally, we sought to validate the preference-card-method in an adult sample.

3.1 Method

3.1.1 Participants

Participants were 89 six- to ten-year-olds (42 female, $M = 8.44$ years, $SD = 1.04$, 13 first-graders, 19 second-graders, 57 third-graders) and 54 students at the University of Erfurt (42 female, $M = 22.3$ years, $SD = 2.92$). We recruited child participants by inviting all local primary schools to participate in an open house at the psychology department's research laboratory. Six classes (one first-grade, one second-grade, three third-grades, and one mixed-

grade) participated in the study. The children were randomly assigned to either the owner or nonowner condition and tested in individual cubicles by an experimenter. Experimenters were hypothesis-blind Bachelor and Master students who were trained to conduct one of the two conditions. Adult participants were recruited from a university-wide participant pool and tested in individual sessions by a single experimenter at the same laboratory.

3.1.2 Materials and procedure

Children participated in the experiment as part of a conceptually unrelated experiment battery that lasted a total of approximately 30 minutes. The endowment task, which lasted approximately five minutes, was framed as a choice between prize-chips, which could be used to purchase unknown prizes at the end of the experiment, and a clear plastic piggy bank. Adult participants took part in the endowment task as a stand-alone experiment that also lasted approximately five minutes. Instead of a piggy bank, adults chose between prize-chips and a dark blue University of Erfurt coffee mug. We used the prize-chip framework because pretests have shown that it is understood equally well by both children and adults in the context of decision making tasks. In addition, because the types of prizes offered can be selected contingent on participants' age-group and are unknown to participants during the endowment task, this framework includes incentivation that is not influenced by participant age.

Experimenters informed participants that they would have the opportunity to receive prize-chips in the course of the experiment and ensured that participants understood that they could purchase more prizes with more prize-chips (see Appendix A for experiment scripts). Participants were unaware of the types of prizes available—e.g., writing utensils, stickers, activity sheets for children and instant coffee, miniature candy bars, tea bags for adults—until after completing the endowment task.

The endowment task began with experimenters showing participants the good (i.e., piggy bank or coffee mug) and placing it on the table in front of them. In the owner condition, experimenters then told participants "The [good] now belongs to you" and that they will have the opportunity to decide between keeping it or selling it in exchange for prize-chips. In the nonowner condition, experimenters told participants "The [good] does not belong to you" and that they will have to opportunity to decide between receiving either the good or prize-chips. Participants were not allowed to touch the good until after the experiment. In addition, both owners and nonowners were exposed to the good for approximately equal periods of time. We eliminated one child who touched the piggy bank from all analyses.

Following the manipulation of ownership, experimenters explained the preference-cards, which were ten 4x6-inch cards representing ten dichotomous choices between different amounts of prize-chips (from one to ten; order (ascending vs. descending) was counterbalanced across conditions) and the good (see Appendix B and Appendix C for children's and adult's preference-cards, respectively). Participants did not know the range of prize-chip amounts printed on the cards prior to completing the task. The good and prize-chips were displayed in pictures, with the respective number of prize-chips shown on the left and the good on the right. The respective number of prize-chips was also shown in numerical format under the picture of the prize-chips. The example card that experimenters used to demonstrate the procedure depicted the choice between zero prize-chips (displayed as a single prize-chip with an "X" over it) and the good. Participants were told that they would respond to each card in the stack, but that only one card would be drawn and implemented at the end of the experiment.

Experimenters ensured that participants had no questions concerning the procedure. They then proceeded to present all ten preference-cards, one after the other, accompanied by the question "Do you want to sell your [good] for [x] prize-chip(s)?" in the owner condition and "Would you rather get [x] prize-chip(s) or the [good]?" in the nonowner condition.

Experimenters circled participants' reported preferences (i.e., either the prize-chips or the good) on the cards before laying them, one after the other, on the table in front of the participants. This ensured that participants did not have to remember their previous preferences while completing the task.[2]

After participants stated their preferences for all ten cards, experimenters restacked the deck and told participants that they have one more question before they draw a card. The question assessed how much participants liked the good ("How much do you like the [good]?") on a seven-point scale. For children, the scale was based on Schlottmann's (2001) wooden stick scale and displayed on paper as seven bars of increasing height with a frowning face under the shortest bar and a smiley face under the longest bar (see Appendix D for scale used with children). Adults were given a piece of paper displaying the question on a seven-point rating scale (1 = *not at all*, 7 = *a lot*) as well as items on age and gender.

Experimenters then shuffled the preference-card deck and randomly drew one card. The preference displayed on the card was then carried out. That is, for owners, if the good was circled, participants kept the good and received no prize-chips; if the prize-chips were circled, participants received the respective amount of prize-chips and relinquished possession of the good. For nonowners, if the good was circled, participants received the good and no prize-chips; if the prize-chips were circled, participants received the respective number of

[2] A pre-test of 85 primary school children indicated that working memory capacity may influence children's responses on the preference-card task. In the pre-test, cards were returned to the deck so that participants could not see their previously reported preferences. Of the first-, second-, and third-graders in the pretest (N = 38), 47 % reported intransitive preferences. Modifying the procedure so that participants' previously stated preferences were visible on the table in front of them resulted in a decrease in the percentage of intransitive responses to approximately 31 % in the current sample.

prize-chips and did not receive the good. Participants then purchased prizes with their prize-chips. Adults were additionally given 1.50 €.

As part of the experiment battery, children also responded to a series of seven questions "How glad would you be if [1, 2, 3, 4, 5, 6, 11] prize-chips were in your piggy bank?" on a 17 point scale analog to the liking scale used in the endowment task.

3.2 Results

3.2.1 Calculation of valuations

The manner in which participants' valuations of the good were determined was the same as typically used in adult samples (e.g., Kahneman et al., 1990) and dependent on experimental condition. For owners, valuations were recorded as the minimum value that a participant would accept in exchange for the good, i.e., the smallest amount of prize-chips that was circled on the preference-cards. For nonowners, valuations were recorded as the maximum amount of prize-chips that a participant would forgo in order to receive the good, i.e., the largest amount of prize-chips that was not circled on the preference-cards. If an endowment effect is present, we would expect owners' valuations (i.e., selling prices) to be higher, on average, than nonowners' valuations (i.e., buying prices).

In the case of intransitive preferences—e.g., when a participant prefers receiving two prize-chips over receiving the good but prefers receiving the good over receiving three prize-chips—it is not possible to calculate valuations in the above mentioned manner because each participant would have more than one valuation. Thus, in order to determine whether the so-called *intransitive responders* in this sample also showed evidence of an endowment effect, we created two new variables as proxies for valuations.

The first variable, *mean_value*, indicates a participant's mean selling or buying price across all ten preference-cards (for owners: the sum of all circled prize-chips divided by the number of cards on which the prize-chips were circled; for nonowners: the sum of all non-

circled prize-chips divided by the number of cards on which the good was circled). For example, if a participant preferred the good over 3, 5, 7, and 10 prize-chips and is an owner, she would have a mean_value of 5 (i.e., [1 + 2 + 4 + 6 + 8 + 9] / 6). If, however, she is a nonowner, she would have a mean_value of 6.25 (i.e., [3 + 5 + 7 + 10] / 4). In the presence of an endowment effect, we would expect owners' mean_values to be higher than those of nonowners.

The second variable, *number_good*, indicates the number of times that a participant preferred the good across all ten preference-cards. For instance, the participant above would have the value 4. If participants misunderstood the preference task to be ten independent decisions rather than a series of questions representing a single decision, one may expect individuals who have a general preference for the good to prefer it more often (i.e., on a greater number of cards) than those who do not. Similarly, one may expect those who do not have a general preference for the good to choose the prize-chips more often (i.e., on a greater number of cards) than those who prefer the good. Thus, if an endowment effect is present, we would expect owners to have higher values on the number_good variable than nonowners.

If the proxy variables are sound substitutes for valuations, they should correlate with valuations in transitive responders. Thus, we tested the validity of these two variables as proxies by calculating correlations between the valuations of transitive responders and their values on the proxy variables.

3.2.2 Endowment effect in participants with transitive responses

Sixty-one children (69 %, 34 owners) and 48 adults (89 %, 24 owners) reported transitive preferences on the endowment task.

We found a very large endowment effect for children, $t(59) = 5.81$, $p < .01$, $d = 1.51$, and a moderate to large effect for adults, $t(46) = 2.09$, $p = .04$, $d = .62$. Thus, owners'

valuations were substantially higher than those of nonowners (see Table 3.1 for descriptive statistics); and the magnitude of this difference was larger for children than adults.

For children, the effect of ownership on preferences is supported by a comparison of owners' and nonowners' responses on the liking scale. Owners liked the piggy bank more than nonowners, $t(59) = 1.83$, $p = .07$, $d = .48$. For adults, we found no difference in liking between owners and nonowners, $t(46) = .10$, $p = .92$, $d = -.03$ (see Table 3.1 for descriptive statistics).

Table 3.1

Means and (Standard Deviations) for Transitive and Intransitive Responders According to Ownership Condition

		Owners	Nonowners
		Transitive	
Children			
	Valuation	7.32 (3.15)	2.74 (2.94)
	Like	5.65 (1.48)	4.93 (1.59)
Adults			
	Valuation	5.38 (2.58)	3.79 (2.67)
	Like	4.21 (1.53)	4.25 (1.23)
		Intransitive	
Children			
	Mean_value	6.34 (0.99)	3.83 (1.06)
	Number_good	5.53 (1.77)	3.23 (2.01)
	Like	5.87 (1.41)	5.08 (1.66)

Further, exploratory analyses of the proxy variables support their validity. The correlation between valuations and mean_value was moderately large in children ($r = .27$, $p = .03$) and large in adults ($r = .67$, $p < .01$), whereas the correlation between valuations and number_good was large in children ($r = .99$, $p < .01$) and adults ($r = .98$, $p < .01$).

3.2.3 Endowment effect in participants with intransitive responses

Twenty-eight children (31 %, 15 owners) and 6 adults (11 %, 2 owners) reported intransitive preferences on the endowment task. Children in this group switched between 2 and 7 times ($M = 3.68$, $SD = 1.42$; zero to one switch is indicative of transitive preferences), while adults switched between 2 and 8 times, $M = 4.33$, $SD = 2.16$. We did not perform additional analyses on adult intransitive responders because the small sample size does not allow for meaningful inferences.

We found evidence of an endowment effect in children for both proxy variables. Owners chose the good more often, the prize-chips less often, $t(26) = 3.23$, $p < .01$, $|d| = 1.28$, and had higher mean_values than nonowners, $t(26) = 6.47$, $p < .01$, $d = 2.54$ (see Table 1 for descriptive statistics).

Children reporting intransitive preferences also showed a similar trend on the liking scale to those reporting transitive responses. That is, owners liked the piggy bank more than nonowners, $t(27) = 1.43$, $p = .17$, $d = .55$ (see Table 3.1 for descriptive statistics). Although this difference did not reach an acceptable level of significance, it is of similar magnitude to that observed in transitive responders.

These results indicate that children who reported intransitive preferences may be equally susceptible to the endowment effect as those reporting transitive preferences. Thus, although these two groups may differ in a systematic manner, this difference does not appear to be related to the occurrence of an endowment effect.

3.2.4 Comparison of transitive and intransitive responders

We performed additional analyses of the child sample to explore possible systematic differences between transitive and intransitive responders. First, we tested whether gender is related to intransitive responses and found no meaningful difference in the percentage of intransitive responders among girls (31%) and boys (27%), χ^2 (1) = .14, $p = .71$.

We then tested for age effects between the two responder groups. Transitive and intransitive responders did not differ in terms of age, $t(86) = 1.12$, $p = .27$, $d = .24$. However, there was a negative relationship between age and the number of switches among intransitive responders ($r = -.26$, $p = .18$). Thus, younger children had more disordered responses than older children but were equally likely to report intransitive preferences.

We found a moderately large relationship between grade in school and the relative number of intransitive responders, χ^2 (2) = 7.68, $p = .02$, $\varphi = .29$. Intransitive responders were most prevalent among first- and third-graders (38% in both groups), while there was only a single intransitive responder among second-graders (5%). The percentage of intransitive responders among third-graders did not differ between school classes, $\chi^2(2) = .28$, $p = .87$, $\varphi = .07$.

We also assessed possible differences between transitive and intransitive responders in terms of understanding the value of the prize-chips. If intransitive responses were due to a lack of understanding of the prize-chip's value (i.e., more prize-chips are more valuable than fewer prize-chips), we would expect to find differences in understanding between the two groups. We calculated the correlation between participants responses to the questions "How glad would you be if [x] prize-chips were in your piggy bank?" and the actual amount of prize-chips (i.e., 1, 2, 3, 4, 5, 6, and 11 prize-chips). Children who understood that having more prize-chips is better than having fewer prize-chips should have reported being more glad to receive, for example, seven prize-chips than they would have been to receive one prize-chip. Thus, values on this variable are higher for children who understood the value of the prize-chips well and lower for those who did not. Children reporting transitive preferences ($M_r = .93$, $SD_r = .66$) and intransitive preferences ($M_r = .93$, $SD_r = .57$) understood that receiving more prize-chips is better than receiving fewer prize-chips approximately equally well, $t_{Zr}(85) = .02$, $p = .99$, $d < .01$. Thus, differences in understanding the value of the prize-chips do not appear to be the cause of the intransitive responses.

3.3 Discussion

In the last several decades, researchers have repeatedly found evidence of an endowment effect in adults (cf., Horowitz & McConnell, 2002). This study is the first to develop a method—*preference-cards*—that is structurally identical to those used in adult studies yet with a scenario that is appropriate for use with children. In doing so, we found evidence of a large endowment effect in a sample of six- to ten-year-olds, while ruling out the possibility that the effect was due to differences in exposure to or touching the good. We also made a first step in validating the preference-card method by applying it to a sample of adults, in which we found an endowment effect of a magnitude in line with findings from other adult studies (cf., Horowitz & McConnell, 2002). Therefore, our findings build on studies that provided valuable first evidence of an endowment effect in children (Harbaugh et al., 2001; Lucas et al., 2008) and thus contribute to the growing body of research demonstrating that children show many of the same judgment and decision making biases as adults.

Approximately one third of the children in this study reported intransitive preferences on the endowment task. Although this percentage is substantially greater than the 11 percent found in the adult sample, there is evidence that intransitivity is to a certain degree simply characteristic of children's preferences (Harbaugh, Krause, & Berry, 2001). In addition, we were able to rule out the possibility that differences in understanding the value of the prize-chips lead to intransitive responses. Although we observed a substantially smaller percentage of intransitive responders among second graders than among first- and third-graders, transitive and intransitive responders were, on average, the same age. Thus, this finding does not appear to be caused by age-related differences. Rather, school- or class-specific characteristics unique to the second-grade-class that were not considered in this study are likely the cause. However, we did find a moderately strong correlation between age and the disorderliness of the intransitivity, indicating that the intransitivity shown by younger children may be stronger than that shown by older children.

Despite this intransitivity, we also found evidence of a large endowment effect in this subgroup using two proxy variables. Thus, we do not believe that the cause of intransitive preferences is related to the endowment effect or that intransitive responses reflect the absence of preferences for or against the good. Indeed, the fact that the preference-card method is sensitive to intransitivity may mean that it provides a more accurate picture of children's preferences than the dichotomous choice methods used in previous studies.

Future research should focus on developing the preference-card method further by examining possible variables that may contribute to this intransitivity in children, such as children's ability to concentrate on the task. Reducing the prevalence of intransitive responses would minimize the necessity for the proxy variables, which would presumably result in more accurate estimates of the magnitude of the endowment effect overall. In addition, studies with larger sample sizes and age ranges that allow for direct comparisons of the endowment effect and the prevalence of intransitivity between age-groups would contribute to our understanding of the development of the endowment effect over the life-span. This, in turn, may provide valuable information pertaining to the diverse theories regarding the cause of the endowment effect.

3.4 References

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3.5 Appendix A

English translation of instructions for preference-card measure (original was in German). E = experimenter.

[ALL] Here I have a [good]. *(E shows the good to the participant and places it on the table in front of him/her)*

[OWNERS] This [good] now belongs to you. In a minute you will have the opportunity to decide whether you would like to keep your [good] or trade it for prize-chips.

[NONOWNERS] This [good] does not belong to you. In a minute you will have the opportunity to decide whether you would like to get the [good] or prize-chips.

[ALL] The prize-chips are play-money that you can use to buy prizes at the end of the experiment. We have a lot of different prizes to choose from. The prizes that you buy are yours to keep.

[OWNERS] If you keep your [good], you get the [good] but do not get any prize-chips. If you sell your [good], you get prize-chips but do not get to keep your [good].

[NONWONERS] If you want the [good], you get the [good] but do not get any prize-chips. If you want the prize-chips, you get prize-chips but do not get the [good].

[ALL] Now you get to decide. Here I have some different offers for you. *(E shows stack of preference-cards)* Each offer is printed on an offer card that looks like this one here. *(E shows example preference-card displaying good and zero prize-chips)*

[OWNERS] Here it says how many prize-chips you would get if you sell your [good]. *(E points to picture of the prize-chip)*

[NONOWNERS] Here is says how many prize-chips you would get if you don't want the [good]. *(E points to picture of the prize-chip)*

[ALL] In this example it says zero prize-chips. *(E points to "0")*

[OWNERS] So you would have to decide whether you want to keep your [good] or sell it for zero prize-chips.

[NONOWNERS] So you would have to decide whether you want the [good] or zero prize-chips.

[CHILDREN] You tell me what you want by pointing to either the prize-chips. *(E points to prize-chip)* or the piggy bank. *(E points to piggy bank)*

[CHILDREN OWNERS] Where would you point if you wanted to sell your piggy bank for the prize-chips? And where would you point if you don't want to sell your piggy bank?

[CHILDREN NONOWNERS] Where would you point if you wanted to get the piggy bank? And where would you point if you wanted to get the prize-chips?

[CHILDREN ANSWERING CORRECTLY] That's right.

[CHILDREN ANSWERING FALSELY] If you want the prize-chips, you point to the prize-chips. If you want the piggy bank, you point to the piggy bank. *(E then repeats test of understanding above)*

[OWNERS] So if, for example, you would rather keep your [good], I would circle the [good]. *(E circles the good)*

[NONOWNERS] So if, for example, you would rather have the [good], I would circle the [good]. *(E circles the good)*

[ALL] I'm going to ask you that question for all of these offers. *(E places example card on top of preference-card deck and shows the deck)* But at the end you won't get every offer. You only get one. After we have filled out all the offer cards, we'll shuffle the deck and randomly draw one card. *(E pretends to shuffle preference-card deck).*Then we'll look and see which offer we drew and then do exactly what you told me to. *(E draws the example card and places it on the table in front of the participant)*

[OWNERS] If, for example, we were to draw this offer at the end, you would keep your [good].

[NONOWNERS] If, for example, we were to draw this offer at the end, you would get the [good].

[ALL] Do you have any questions? Now I'll show you the offers. *(E places the first preference-card on the table in front of the participant)*

[OWNERS] Do you want to sell your [good] for [x] prize-chips? *(E circles the participant's answer and then repeats for every preference-card)*

[NONOWNERS] Do you want [x] prize-chips or the [good]? *(E circles the participant's answer and then repeats for every preference-card)*

[ALL] So, that was all the offers. Now we're going to shuffle the cards. *(E shuffles the preference-card deck)* Before we draw a card, I have one more question for you.

[CHILDREN] How much do you like the piggy bank? *(E places piece of paper with scale on the table in front of the participant)* If you like it a lot, please make a mark on this line. *(E points to longest line)* If you don't like it at all, please make a mark on this line. *(E points to the shortest line)* If you like the piggy bank but don't like it a lot, make a mark on one of the lines in-between. *(E points to the middle lines)* So, how much do you like the piggy bank?

[ADULTS] Please fill this out. *(E gives participant piece of paper with like scale and demographic questions)*

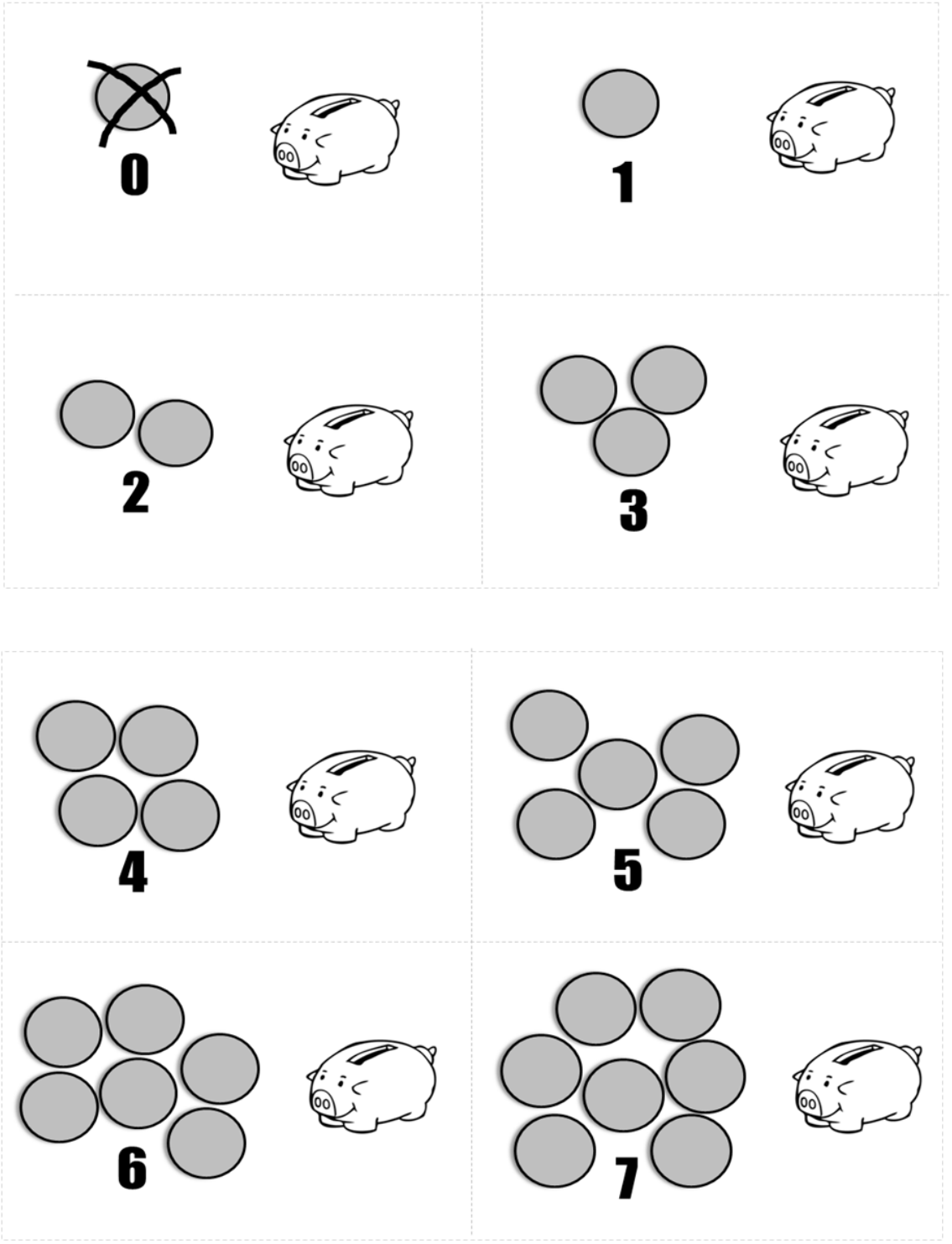
[ALL] So, now we're going to draw a card. *(E randomly draws a card from the preference-card deck)* This is the offer. *(E places card on table in front of participant)*

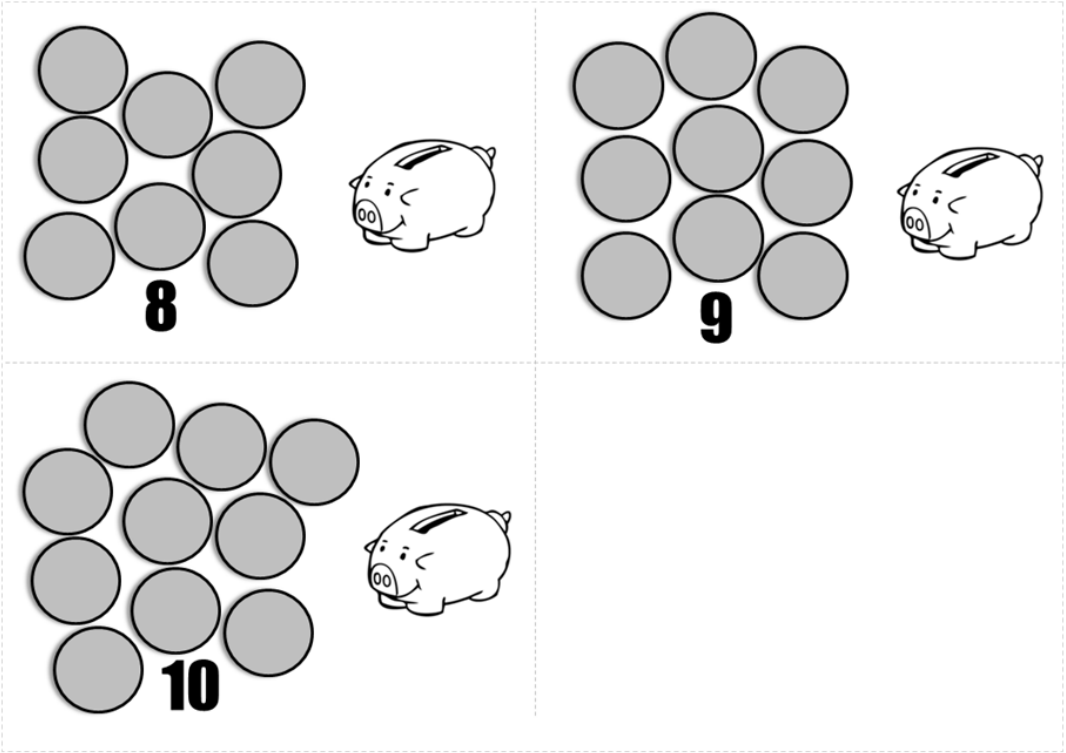
[OWNERS] So you get to keep your [good] / get [x] prize-chips.

[NONOWNERS] So you get the [good] / [x] prize-chips.

3.6 Appendix B

Preference-cards used with child participants.

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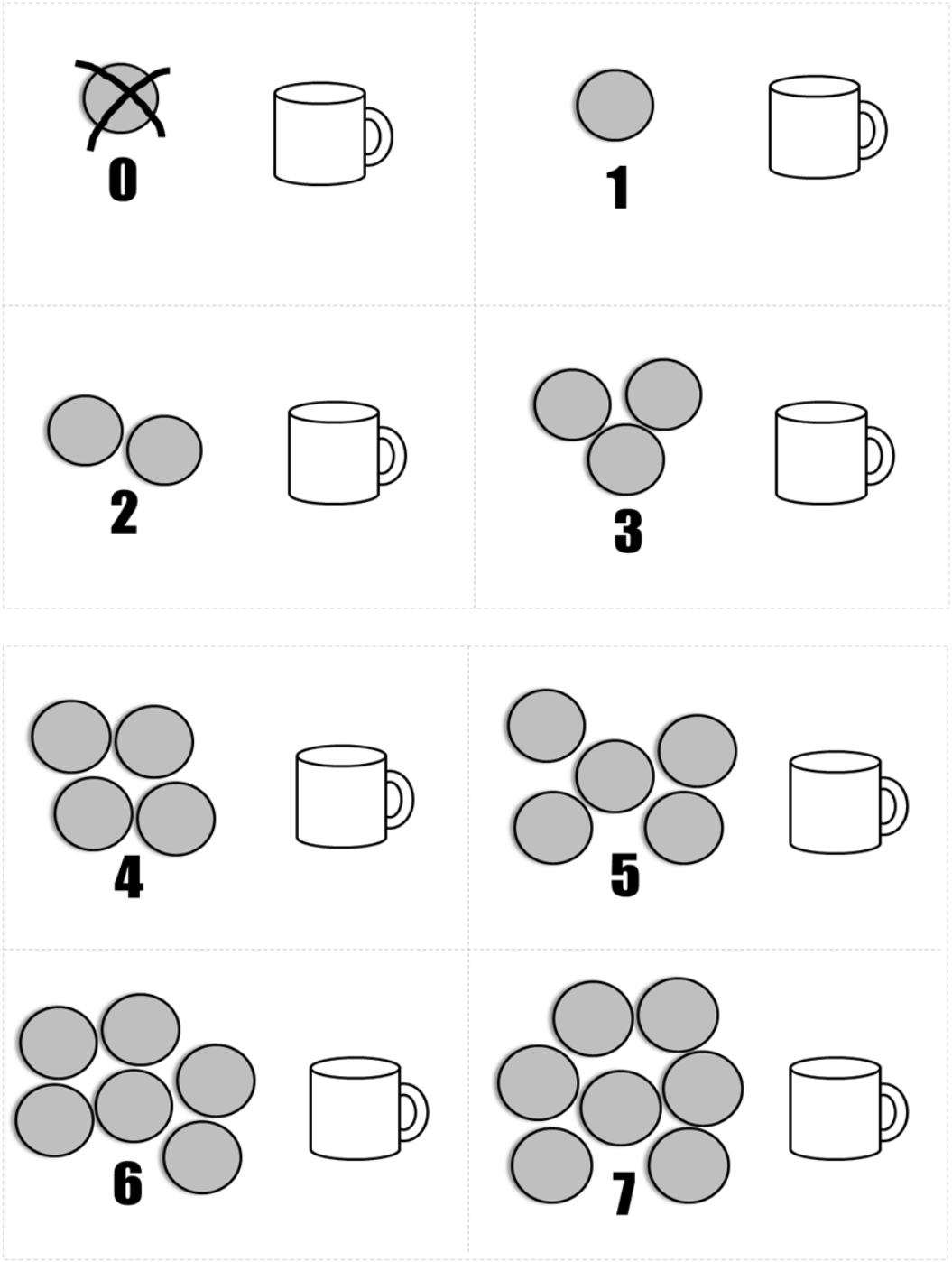
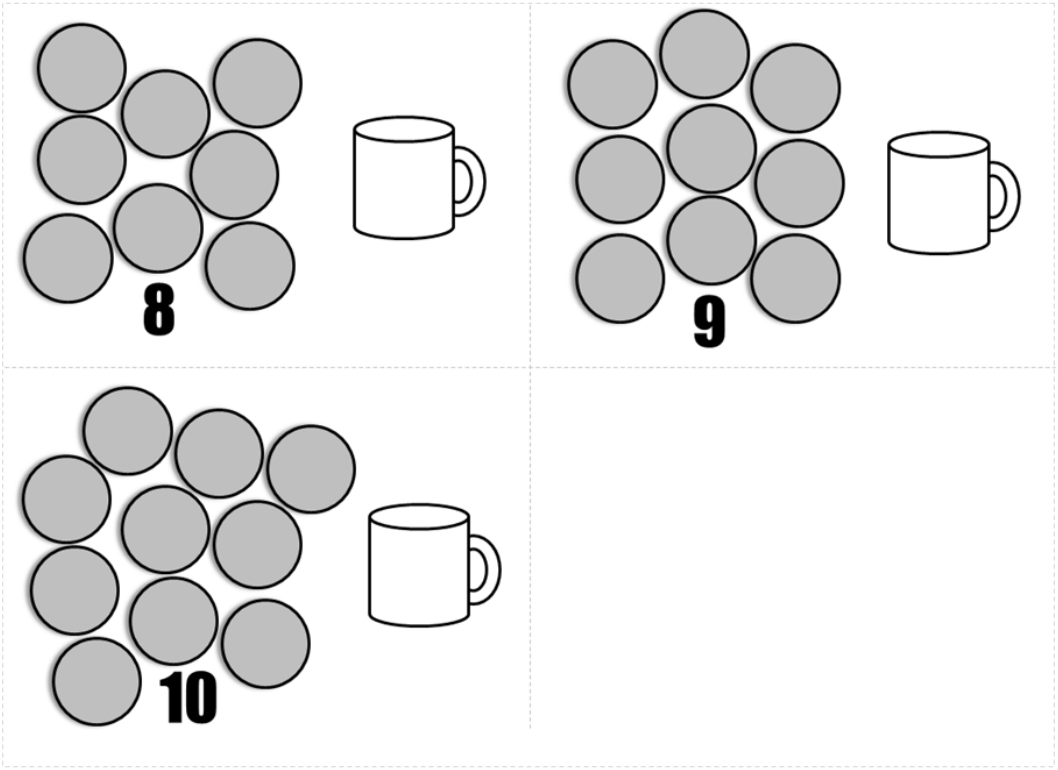
3.7 Appendix C

Preference-cards used with adult participants.

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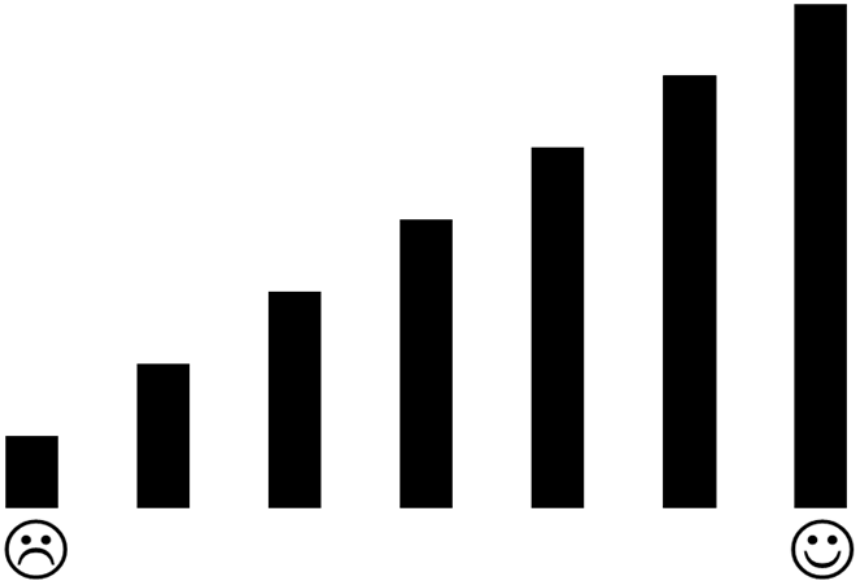
3.8 Appendix D

Liking scale used with child participants.



4. Study 3

The endowment effect in children and adults

In Study 2, we adapted the Becker, DeGroot, and Marschak (BDM) measure of the endowment effect (1964; for details on BDM measure, see Study 1)—one of the most commonly used endowment effect measures in research on adults—for use in children. The resulting *preference-card* measure adheres to methodological guidelines considered standard in adult endowment effect research, making it possible to use the method in adult samples, as well, without jeopardizing methodological quality. When comparing age-groups, the use of a single measure is desirable, as the type of measure used to assess value judgments can influence the reliability of results (Horowitz & McConnell, 2002). As demonstrated in Study 2, the preference-card measure is a promising alternative to the dichotomous choice measure previously used to compare the endowment effect in children and adults (for details and discussion of dichotomous choice measure, see Study 2).

The purpose of the current study is to address the question whether the endowment effect is a stable characteristic of human judgment or a behavior highly dependent on individual trading experience by comparing the effect in children and adults using the preference-card measure. If the endowment effect is a stable characteristic of human judgment, we would expect the effect to remain relatively stable even across long periods of time—thus, the effect magnitude should be similar in children and adults. If, however, the endowment effect is dependent on trading experience, the effect magnitude should differ considerably between children and adults, as the latter have substantially more experience trading goods.

There exists evidence in support of both notions. Some researchers, for instance, claim that the valuation disparity characteristic of the endowment effect is due to a *sell high, buy low* impulse learned in everyday trading experiences and diminishes or even disappears when

individuals are provided the opportunity to learn that such behavior is maladaptive in the experimental context (Brookshire & Coursey, 1987; Shogren, Shin, Hayes, & Kliebenstein, 1994). Still others claim that the endowment effect is caused by a lack of everyday trading experience, in that trading novices but not experienced traders demonstrate the effect (List, 2003, 2004). There is also evidence that the endowment effect is unaffected by experience (Kahneman, Knetsch, & Thaler, 1990; Knez, Smith, & Williams, 1985; Morrison, 1997).

To date, only one study known to the authors has compared the magnitude of the endowment effect in children and adults. This study demonstrated that the effect remains relatively stable from kindergarten-age through adulthood (Harbaugh, Krause, & Vesterlund, 2001), thus providing support for the notion that the endowment effect is stable and not dependent on trading experience. However, Harbaugh and colleagues implemented the dichotomous choice measure, which may be problematic when comparing different age groups (for detailed discussion, see Study 2). Thus, we sought to add to these first findings by comparing the magnitude of the endowment effect between children and adults using a measure that is better suited for comparing different age groups.

We also tested whether we were successful in developing a child-friendly measure of the endowment effect that still conforms to the standards in adult research. To do so, we additionally measured the endowment effect in adults using the BDM measure—the standard on which the preference-card measure is based. If both the preference-card and BDM measures perform in a similar manner, we would expect to find similar results in a single sample using both measures. Finally, in order to compare the performance of the preference-card measure to that of the standard measure typically used in child samples, we measured the endowment effect in both age groups using the dichotomous choice measure.

4.1 Method

4.1.1 Participants

Child participants were 70 eight- to eleven-year-olds (M_{age} = 9.46 years, SD = .70, 38 female) from a local primary school attended primarily by children from middle-class families. Adult participants were 80 individuals (M_{age} = 22.43, SD = 2.43, 65 female) recruited from a psychology participant pool at the University of Erfurt.

4.1.2 Design and materials

The experiment had a 2 (ownership: owner vs. nonowner) x 2 (age-group: children vs. adults) x 3 (measure: preference-cards vs. BDM vs. dichotomous choice) design. Ownership and age-group were between-subjects factors, whereas measure was manipulated within subjects. Children completed only the preference-card and dichotomous choice measures, as the BDM measure requires adult-level reading and reasoning skills. Adults completed all three measures.

The preference-card measure was conducted exactly as described in Study 2. The dichotomous choice task was conducted in a similar manner to that used in a previous study examining the endowment effect in children and adults (Harbaugh et al., 2001). Participants were randomly given one of two items and told "This [item] now belongs to you". They were then given the choice to trade their endowment for the second item (see Appendix for original instructions). Participants were allowed to keep the item that they preferred in each item-pair. As in the study from Harbaugh et al. (2001), we used age-specific item-pairs to ensure that item-pairs were appealing to participants—thus, item-pairs differed across age-groups. We selected item-pairs to be maximally similar in terms of color, price, and type of good—the latter because numerous studies have shown that good type plays a role in the endowment effect (e.g., exchange vs. consumption goods, cf., Kahneman et al., 1990; ordinary market vs. nonmarket goods, cf., Horowitz & McConnell, 2002). The item-pairs were: for children, 1)

white eraser vs. small, clear-plastic ruler, 2) colored pencil vs. colored marker (items were color-matched), and 3) sticker vs. animal-shaped rubber band (items were color-matched); for adults, 1) two different, miniature-sized packages of gummy candy, 2) ball-point pen vs. small pad of sticky-notes, and 3) small bottle of water vs. travel-pack of tissues. Item-pairs were always presented in the order listed above—i.e., the ascending order of objective monetary value. If an endowment effect is present, an item should be preferred more often by participants who were endowed with it.

Adult participants additionally completed the BDM measure described in Study 1 (Experiment 1) for a brand-name chocolate bar. The 40 monetary amounts varied between 5 cents and 2.00 € in increments of 5 cents. Although brand loyalty may influence participants' valuations, this factor is presumably normally distributed in the sample. We chose this particular type of chocolate bar because it was highly familiar to participants and its approximate true market value generally known. As the endowment effect is typically smaller for ordinary market goods (Horowitz & McConnell, 2002), the use of a familiar chocolate bar should lead to a more conservative estimate of the effect.

4.1.3 Procedure

Children participated in the experiment during after-school-daycare at their school. The individual sessions lasted approximately 15 minutes and were conducted by two female, hypothesis-blind graduate psychology students trained to conduct both ownership conditions. All children completed the preference-card measure first to avoid the possibility that the stronger manipulation of ownership used for the dichotomous choice measure (i.e., opportunity to touch and thoroughly inspect objects) would reduce the effectiveness of the weaker ownership manipulation used in the preference-card task (i.e., opportunity only for visual inspection). Upon entering the room, the children were seated at a table next to the experimenter. The experimenter then explained and conducted the preference-card experiment

exactly as described in Study 2. The experimenter then explained and conducted the dichotomous choice task before asking participants how much they liked each object using the 7-point bar scale used in Study 2. Finally, the experimenter randomly selected one of the preference-cards and carried out the transaction (see Appendix for original instructions). Children who received prize-chips were then allowed to purchase two prizes (e.g., writing utensils, notepads, etc.).

Adults participated in individual 30-minute sessions with a single experimenter (the first author) at the university's psychology lab. The order in which participants completed the BDM and preference-card measures was counterbalanced to avoid order effects. All participants completed the dichotomous choice task last in order to avoid compromising the comparatively weaker ownership manipulation used in the first two measures. For the preference-card task, participants were seated at a table across from the experimenter. The experimenter explained and conducted the preference-card task exactly as described in Study 2. For the BDM measure, participants were directed to a cubicle and either given (owners) or shown (nonowners) a chocolate bar. Owners then read that the chocolate bar belongs to them and that they will have the opportunity to decide whether they would like to sell it for cash. Nonowners read that they would have to opportunity to decide between receiving either the chocolate bar or cash. All participants then read the same instructions and completed the same BDM measure as used in Study 1 (Experiment 1). Following the BDM measure, participants responded to 7-point rating scales measuring the following: the exploratory variable liking ("How much do you like the chocolate bar?" 1 = *not at all*, 7 = *extremely well*); and subjective information about the chocolate bar ("I have an adequate amount of information in order to evaluate the chocolate bar." 1 = *not at all*, 7 = *absolutely*) as a control variable. Participants then provided demographic information. Finally, participants were seated once again at the table with the experimenter, who conducted the dichotomous choice task and then asked participants to indicate how much they liked each item on a 7-point rating scale ("How

much do you like the [item]?" 1 = *not at all*, 7 = *extremely well*). The experimenter then randomly drew one preference-card and a cash amount (BDM measure) and carried out both transactions. Participants who received prize-chips were then allowed to purchase two prizes (e.g., instant coffee, candy bars, office supplies, etc.).

4.2 Results

4.2.1 Calculation of valuations

BDM measure and preference-card task. We computed valuations in the same manner as described in Study 1 (BDM) and Study 2 (preference-cards). That is, owners' valuations were computed as the minimum amount of cash/prize-chips that an individual would accept in exchange for the good, whereas nonowners' valuations were computed as the maximum amount of cash/prize-chips that an individual would forgo in order to obtain the good. If an endowment effect occurs, we would expect valuations to be higher in owners than nonowners.

In the case of intransitive preferences, we computed the two proxy variables described in Study 2: *mean_value* indicates a participant's mean selling (owners) or buying price (nonowners) across all ten preference-cards; *number_good* indicates the number of preference-cards on which a participant circled the good. In the presence of an endowment effect, we would expect owners' values on both proxy variables to be greater than those of nonowners.

Dichotomous choice task. For each item-pair, we computed the *endowment boost*—i.e., the increase in likelihood that an item was chosen by participants who were endowed with it as compared to participants who were not endowed with the item. For example, if 60 percent of participants endowed with item 1 preferred it over item 2, and 40 percent of participants endowed with item 2 preferred item 1, the endowment boost would be 60 / 40 = 1.5 (for additional example calculations, see Harbaugh et al., 2001). An endowment boost

greater than 1 indicates that the item was more likely to be chosen by participants who were initially endowed with it; an endowment boost equal to 1 indicates that the item was equally likely to be chosen by endowed and nonendowed participants. Thus, in the example above, item 1 was 1.5 times more likely to be chosen if an individual was initially endowed with it. We calculated the endowment boost for each item in a pair and then computed an average endowment boost for each item-pair. Finally, we tested whether each average endowment boost was significantly different from 1 (i.e., no endowment effect) using Fisher's exact test.

4.2.2 BDM measure

Seventy-eight adults (97 %, 40 owners) reported transitive preferences on the BDM measure. We refrained from analyzing the data on the two participants (3 %, 1 owner) reporting intransitive preferences due to the small sample size. Participants reporting transitive preferences showed evidence of a moderately large endowment effect—owners (M = 1.09, SD = .38) attributed the chocolate bar significantly greater value than nonowners (M = .88, SD = .38), $t(76) = 2.43$, $p = .02$, $d = .56$. There was no effect of ownership on liking, $t(78) = .22$, $p = .82$, $d = .05$; $M_O = 4.80$, $SD_O = 1.71$; $M_{NO} = 4.72$, $SD_{NO} = 1.76$. In addition, owners (M = 5.66, SD = 1.53) and nonowners (M = 5.41, SD = 1.43) reported having similar amounts of information on the chocolate bar, $t(78) = .75$, $p = .46$, $d = .17$.

4.2.3 Preference-card task

Endowment effect in participants with transitive responses. Thirty-five children (50 %, 19 owners) and 73 adults (91 %, 34 owners) reported transitive preferences on the preference-card task. We conducted independent samples t-tests with valuations as the dependent variable in order to test for an endowment effect in both age groups. The endowment effect was large in both age-groups and significantly larger in children, $t(33) = 9.81$, $p < .01$, $M_{diff} = 5.94$, 95 % $CI = 4.71 - 7.17$, $d = 3.42$, than adults, $t(71) = 3.73$, $p < .01$, $M_{diff} = 2.17$, 95 % $CI = 1.01 - 3.33$, $d = .89$ (see Table 4.1 for means and standard deviations

in all conditions). Thus, the results both confirm the findings of Study 2 that both children and adults show an endowment effect on the preference-card measure and provide support to the notion that the endowment effect may be dependent on trading experience. In addition, they provide support for the notion that the preference-card measure performs similarly in adults to the BDM measure.

Table 4.1

Preference-Card Measure Means and (Standard Deviations) on all Dependent Variables for Transitive and Intransitive Responders

	Children		Adults	
	O	NO	O	NO
		Transitive		
Valuations	7.00 (2.06)	1.06 (1.39)	6.12 (2.71)	3.95 (2.26)
Liking	5.26 (1.24)	4.13 (1.71)	4.83 (1.20)	4.30 (1.24)
Mean_value	7.95 (2.13)	.78 (.91)		
Number_good	6.00 (2.06)	1.06 (1.39)		
		Intransitive		
Mean_value	6.21 (1.65)	4.73 (1.61)		
Number_good	5.64 (1.95)	3.62 (1.86)		
Liking	4.86 (1.10)	5.14 (1.11)		

Note. O = owners, NO = nonowners.

For exploratory purposes, we computed the two proxy variables for children reporting transitive preferences. Transitive responders showed a large endowment effect in the case of both mean_value, $t(33) = 12.52$, $p < .01$, $d = 4.36$, and number_good, $t(33) = 8.16$, $p < .01$, $d = 2.84$. The correlations between participants' valuations and values computed for mean_value and number_good were large—$r = .82$, $p < .01$ and $r > .99$, $p < .01$, respectively.

This supports our conclusion in Study 2 that the proxy variables may be interpreted in the same manner as valuations.

Finally, the effect of ownership on liking was moderately large in adults, $t(78) = 1.92$, $p = .06$, $d = .44$, and large in children, $t(33) = 2.28$, $p = .03$, $d = .79$.

Endowment effect in participants with intransitive responses. Thirty-five children (50 %, 14 owners) and 7 adults (9 %, 6 owners) reported intransitive preferences on the preference-card task. Children switched an average of 4.09 times ($SD = 2.01$; zero to one switch is indicative of transitive preferences), while adults switched an average of 3.00 times ($SD = 1.00$). We refrained from conducting analyses on the adult intransitive responders due to the small sample size.

In children, there was a large effect of ownership on both mean_value, $t(33) = 2.64$, $p = .01$, $d = .92$, and number_good, $t(33) = 3.10$, $p < .01$, $d = 1.08$. Thus, the results again confirm the findings of Study 2 that intransitive responders also demonstrate an endowment effect. We found no difference in liking between owners and nonowners reporting intransitive preferences, $t(33) = .75$, $p = .46$, $d = .26$. See Table 4.1 for means and standard deviations of owners and nonowners on all dependent variables.

4.2.4 Dichotomous choice measure

Comparisons of item liking for each item-pair. We first examined whether participants liked both items in each of the three item-pairs equally well. Dependent samples *t*-tests indicate that children liked the eraser ($M = 5.64$, $SD = 1.38$) more than the ruler ($M = 4.84$, $SD = 1.62$) in the first item-pair, $t(69) = 3.13$, $p < .01$, $d = .53$. In the case of the second item-pair, children liked the colored pencil ($M = 4.71$, $SD = 1.71$) and the colored marker ($M = 4.93$, $SD = 1.63$) equally well, $t(69) = .73$, $p = .47$, $d = .13$. Finally, in the third item-pair, children liked the rubber band ($M = 5.16$, $SD = 1.85$) more than the sticker ($M = 4.37$, $SD = 1.67$), $t(69) = 2.51$, $p = .01$, $d = .45$.

Adults liked one type of gummy candy ($M = 4.58$, $SD = 1.82$) significantly more than the other ($M = 2.61$, $SD = 1.87$) in the first item-pair, $t(79) = 6.93$, $p < .01$, $d = 1.07$. For the second item-pair, adults liked the pen ($M = 4.25$, $SD = 1.38$) and the sticky notes ($M = 4.31$, $SD = 1.43$) equally well, $t(79) = .26$, $p = .80$, $d = .04$. Finally, for the third item-pair, adults liked the water ($M = 5.38$, $SD = 1.49$) more than the tissues ($M = 3.56$, $SD = 1.42$), $t(79) = 8.24$, $p < .01$, $d = 1.25$.

To ensure that systematic differences in item liking did not influence subsequent estimates of the endowment effect, we analyzed only the item-pairs with equal liking ratings—i.e., colored pencil vs. colored marker for children and pen vs. sticky notes for adults.

Table 4.2

Percentage of Participants Who Chose Each Item in Pair 2 Based on Initial Endowment

		Item preferred		*N*
Item endowed		1	2	
		Children[a]		
1		43.59	56.41	39
2		45.16	54.84	31
	N	31	39	70
		Adults[b]		
1		57.89	42.11	38
2		45.24	54.76	42
	N	41	39	80

[a]1 = pencil, 2 = marker.
[b]1 = pen, 2 = sticky notes.

Endowment boost. In children, the endowment boost for the second item-pair was not significantly different from zero, endowment boost = .97, *p*-value (two-sided) of hypothesis of no endowment effect = .47 (see Table 4.2 for descriptive statistics for children and adults). Thus, children were equally likely to prefer an item regardless of whether they were initially

endowed with it. Adults, on the other hand, were 1.31 times more likely to choose an item if they were initially endowed with it—however, this effect was not significantly different from zero, *p*-value (two-sided) of hypothesis of no endowment effect = .82. Therefore, the dichotomous choice measure provided no evidence of an endowment effect in children and tentative evidence of an endowment effect in adults.

4.3 Discussion

In this study, we addressed the question of whether the endowment effect is a stable characteristic of human judgment or a behavior dependent on individual trading experience by comparing the effect magnitude between children and adults using the preference-card measure. If the endowment effect is a stable characteristic of human judgment, we would expect the magnitude of the effect to be similar between children and adults. If, however, the endowment effect is dependent on trading experience, we would expect the effect magnitude to differ substantially between the age groups, as adults possess markedly more trading experience than children. We had no expectations regarding the possible direction of such a difference, as empirical findings regarding the influence of trading experience on the endowment effect are mixed. While some researchers argue that trading experience causes the endowment effect (e.g., Brookshire & Coursey, 1987; Shogren et al., 1994), others present evidence that trading experience may eliminate the effect (e.g., List, 2003, 2004).

Using the preference-card measure, we found evidence of an endowment effect in both children and adults, whereas the effect magnitude was significantly larger in the former. Thus, the findings indicate that the endowment effect is not a stable characteristic of human judgment. Instead, they provide support to the notion that trading novices are more susceptible to the endowment effect than experienced traders (List, 2003, 2004).

We also tested whether we were successful in developing a child-friendly measure of the endowment effect that still conforms to the standards in adult research by comparing the

endowment effect in adults using both the preference-card and BDM measures (see Table 4.3 for summary of findings for all three measures). We found evidence of an endowment effect in adults using both measures. Although the effect magnitude was somewhat larger for the preference-card measure, this may be attributable in part to the different goods used—i.e., the highly familiar chocolate bar used for the BDM measure may have lead to a more conservative effect estimate than the somewhat more unfamiliar university coffee mug used for the preference-card measure (cf., Horowitz & McConnell, 2002). Overall, both effect magnitudes are consistent with those typically observed in adult samples (Horowitz & McConnell, 2002; Sayman & Öncüler, 2005).

Table 4.3

Evidence of Endowment Effect in Children and Adults

	Preference-cards	BDM	Dichotomous choice
Children	$d = 3.42$		$EB = .97$
Adults	$d = .89$	$d = .56$	$EB = 1.31$

Note. EB = endowment boost.

Finally, in order to compare the performance of the preference-card measure to the standard measure used in child samples, we additionally examined the endowment effect in children and adults using the dichotomous choice measure. Although we found a trend for an endowment effect in adults, which provides tentative support for previous studies (e.g., Knetsch, 1989), we found no evidence of an endowment effect using the dichotomous choice measure in children. This finding contrasts greatly with those of previous studies (Harbaugh et al., 2001; Lucas et al., 2008). Because we adopted the procedure used in such studies as exactly as possible, this indicates that the dichotomous choice measure may be unreliable. As in previous studies (e.g., Harbaugh et al., 2001; Lucas et al., 2008), we also experienced the problem that, in both children and adults, the items in two item-pairs were not liked equally

well. As a result, we were only able to examine the data from a single item-pair in each age-group. This loss of data could potentially be avoided by pretesting item-pairs in each age-group. However, child participants are often difficult to recruit; thus, a measure that does not require such pre-testing, such as preference-cards, is certainly more economical and thus preferable.

Overall, the current study provides evidence that the endowment effect does not remain stable between childhood and adulthood. Instead, the effect appears to be markedly more pronounced in children, which may be attributed to a lack of trading experience. Of course, trading experience is not the only variable that differs greatly between children and adults. Executive functioning such as attentional control, for instance, develops substantially during that time period, which may also account for the differences observed here. Future studies, therefore, should explore other possible influential factors in the endowment effect across the lifespan (for a detailed discussion of the role of executive functioning in endowment effect research, see Section 5.2 in this manuscript). Studies with older adults, who presumably possess substantially more trading experience than the young adults in this study, would also provide valuable insight into the role of experience in the endowment effect.

4.4 References

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4.5 Appendix

English translation of instructions for dichotomous choice task (original was in German). E = experimenter.

Here I have a [item A]. This [item A] now belongs to you. *(E gives participant item A)*
But if you want, you can trade your [item A] for this [item B]. *(E gives participant item B)*
So, would you rather keep your [item A] or trade it for [item B]? *(E repeats for each item-pair)*

5. General discussion

This dissertation aimed to contribute to the endowment effect literature with two distinct approaches. First, we explored the psychological mechanisms behind the concept of ownership in endowment effect experiments. More specifically, we distinguished between the effects of factual ownership and psychological ownership on individuals' valuations (Study 1). Second, we developed a new, child-friendly measure of the endowment effect and used this to compare the effect in children and adults (Study 2 and 3). The key findings as well as a discussion of their theoretical and practical implications are presented in the following.

5.1 Key findings

5.1.1 The endowment effect is caused by factual and not psychological ownership

The endowment effect has traditionally been viewed as a difference in valuations between owners and nonowners, where ownership is understood in a factual, legal sense. Recent studies have called this understanding of the endowment effect into question by demonstrating that psychological ownership, i.e. the feeling of ownership, is either the sole (Reb & Connolly, 2007) or an additional cause of the endowment effect (Peck & Shu, 2009; Wolf, Arkes, & Muhanna, 2008). However, although we attempted to replicate these findings both directly and conceptually in three experiments, we found no support for this notion. Instead, our findings clearly show that psychological ownership is neither a necessary nor sufficient cause of the endowment effect. Although we also demonstrate that other factors can lead to differences in valuations, such as the ability to touch discussed below, our findings confirm the traditional understanding of the endowment effect—i.e., the attribution of greater value to a good due to factual ownership.

These findings have implications for future research on the endowment effect as well as the interpretation of past findings. That is, although the diverse ownership manipulations found in the literature on the endowment effect likely lead to differences in psychological

ownership at least some of the time, these differences are not likely to affect findings regarding the presence and magnitude of the endowment effect. Still, psychological ownership may be a useful concept in endowment effect research. For instance, measures of psychological ownership may be used as a means to ensure that manipulations of ownership were successful—this seems especially valuable when only weak ownership manipulation is possible, such as in studies addressing hypothetical ownership or survey research, or when participants' understanding of the manipulation may be questionable, such as when examining the effect in children.

5.1.2 The ability to touch may increase participants' valuations but not psychological ownership

Previous studies examining the role of psychological ownership in the endowment effect used the ability to touch as a means to induce psychological ownership (Reb & Connolly, 2007; Peck & Shu, 2009; Wolf et al., 2008). We attempted to replicate these findings in two experiments. However, we found that touch did not consistently lead to psychological ownership. Still, participants' valuations were sometimes positively influenced by the ability to touch irrespective of their ownership status and experienced psychological ownership. Thus, although previous theories speculate that the endowment effect observed in many studies may be an inadvertent confounding effect of psychological ownership through touch rather than an effect of factual ownership—i.e., when owners have the ability to touch and nonowners do not (cf., Reb & Connolly, 2007)—this does not appear to be the case. Indeed, even if touch did affect psychological ownership as proposed by previous studies, increases in psychological ownership do not appear to lead to subsequent increases in valuations, as discussed above.

Still, touch is an important factor to consider when designing an endowment effect experiment, as it can affect individuals' valuations. Researchers have shown, for example,

that the ability to touch may increase individuals' willingness to donate time and money (Peck & Wiggins, 2006) as well as the incidence of unplanned purchasing (Peck & Childers, 2006). For some, the act of touching a neutral or positively valenced object leads to a greater affective reaction that, in turn, affects monetary valuations (Peck & Wiggins, 2006). Touch has also been shown to increase purchasing likelihood (McCabe & Nowlis, 2003) and preferences for certain goods (Klatzky, Lederman, & Matula, 1993). We also found evidence that touch may lead to greater valuations by increasing liking. Thus, it is possible that the magnitude of the endowment effect observed in studies that allow owners but not nonowners to touch the good is inflated by the additional effect of touch on individuals' valuations. Future studies should therefore ensure that touch is held constant across ownership conditions to avoid possible confounding effects.

5.1.3 The preference-card measure is a promising means to examine the endowment effect in different age groups

In two studies, we demonstrated that the preference-card measure—a child-friendly adaptation of the commonly used Becker, DeGroot, and Marschak (1964) measure—was successfully adapted to the child domain, yet still performs in adults similarly to the standard measure on which it was modeled. The preference-card measure has an advantage over the dichotomous choice measure previously used in child studies, as it conforms to current standards in adult research on the endowment effect, yet does not require participants to choose between two different items. All studies to date using the dichotomous choice measure in children (Harbaugh et al., 2011; Lucas et al., 2008), including the two experiments described in this manuscript, were forced to disregard portions of data because participants did not always view both items within the item-pairs to be equally valuable. This problem could only be solved by pre-testing the item pairs prior to conducting the experiment—in the case of child participants, this would require considerable additional resources, as access to

this participant group is often limited. Thus, by requiring only a single item for each age group, the preference-card measure reduces or even eliminates the need for pre-testing. Because preference-cards also perform similarly in adults to the standard BDM measure, the measure represents an economical and methodologically sound alternative for comparing the endowment effect in children and adults.

It is possible that the endowment effect observed using the preference-card measure was simply a methodological artifact. That is, due to the way in which maximum buying prices and minimum selling prices are calculated, selling prices will automatically be higher than buying prices even if owners and nonowners report equal preferences (e.g., a participant who prefers the good over all amounts up to 5 prize-chips and then prefers all amounts of 6 prize-chips and more would have a minimum selling price of 6 is she is an owner and a maximum buying price of 5 if she is a nonowner). Thus, a mean difference of 1 between the valuations of owners and nonowners would still be expected if participants' preferences were equal in both groups. Post-hoc examination of the mean differences and their 95 % confidence intervals, however, indicates that all mean differences are significantly greater than 1 except in the case of the adult sample in Study 2.[3] Because this sample was also substantially smaller than those collected in the remaining studies, it is possible that this nonsignificant effect is due to low power. Overall, the endowment effect observed using the preference-card measure does not appear to be a methodological artifact.

5.1.4 The endowment effect is larger in children than adults

In Study 2 and 3, we found not only support for previous findings that children demonstrate an endowment effect (Harbaugh et al., 2001; Lucas et al., 2008) but also

[3] Mean differences and 95 % confidence intervals are as follows: Study 2 children, 4.58 (3.00 - 6.16); Study 2 adults, 1.58 (-.06 - 3.11); Study 3 children, 5.94 (4.71 - 7.17); Study 3 adults, 2.17 (1.01 - 3.33).

evidence that the effect is substantially larger in children than adults. Thus, while our findings contribute to a growing body of research that children show the same judgment and decision making biases as adults (e.g., conjunction fallacy, Davidson, 1995; framing effect, Schlottman & Tring, 2005), they also indicate that this particular bias is not a stable characteristic of human judgment. One possible explanation for this finding is that everyday market experience, which increases with age, eventually leads to a reduction or even elimination of the endowment effect (List, 2003, 2004). However, there are other possible explanations for our findings. For instance, it is possible that differences in ownership are more salient for children than adults or that the former place more value on ownership than the latter. Such explanations are plausible considering the dominant role that ownership plays in children's everyday interactions (e.g., Furby, 1978). The observed differences between children and adults may also be due, at least in part, to developmental differences in executive functioning, which are discussed in detail in the following section.

5.2 Executive functioning development and the endowment effect

When examining the endowment effect in individuals of different ages, it is of key importance to consider developmental differences in executive functioning. Such differences may not only affect the occurrence and/or magnitude of the endowment effect but also the performance of different methods of measurement.

Executive functioning can be viewed in terms of four distinct, inter-dependent domains that continue to develop until adulthood: 1) attentional control, 2) information processing, 3) cognitive flexibility, and 4) goal setting (for overview, see Anderson, 2002). A comprehensive examination of executive functioning and its development would go beyond the scope of this manuscript; therefore, we will address only aspects of executive functioning that may have a direct influence on the endowment effect or its measurement. As it relates to endowment effect research, the domain of attentional control involves the ability to

selectively attend to specific stimuli, focus attention for prolonged periods of time, inhibit responses, and regulate and monitor one's actions so that plans are executed as intended. Developments in this domain greatly influence other executive functioning processes (for overview of all four domains, see Anderson, 2002). Information processing includes the efficiency and speed of cognitive output, whereas cognitive flexibility involves the ability to divide one's attention and concurrently process multiple sources of information. In addition, this domain also includes working memory. Finally, the domain of goal setting includes, among other abilities, the ability to approach tasks in an efficient and strategic manner.

Understanding the role that executive functioning plays in the endowment effect is made difficult by the fact that each domain has a unique developmental trajectory that may affect the functioning of other domains (cf., Anderson, 2002). In the following sections, we discuss how the development of each of the first three domains may affect the occurrence of the endowment effect and its measurement. As the fourth domain, goal setting, is not relevant to the discussion here, we do not address it further.

5.2.1 Attentional control

Improvements in attentional control appear to take place until mid to late childhood. Whereas the speed and accuracy of impulse control improves until around six years of age, reasonably good monitoring and regulation of one's attention and actions is not achieved until approximately nine years. In addition, a temporary increase in impulsivity has been observed in eleven-year-olds (for overview, see Anderson, 2002).

Differences in attentional control ability may thus account for, at least in part, the comparatively large percentage of intransitive responses on the preference-card measure observed in children as compared to adults, as all children in the samples were between six and eleven years of age. Deficits in attentional control, for instance, could make it difficult for children to focus their attention for the entire duration of the preference-card measure, thus

causing multiple switching points simply due to inattentiveness. This notion is supported by the data from Study 2, which indicated a negative relationship between age and the disorderliness of intransitive responses.

It is also possible that attentional deficits led children to change the focus of their attention while completing the preference card measure. This may have then caused their preferences to change during the task, as researchers have demonstrated that the endowment effect is mediated by individuals' attentional focus—adults tend to focus either on the good and its value increasing attributes, in the case of owners, or the money and value decreasing attributes of the good, in the case of nonowners (Ashby, Dickert, & Glöckner, 2012; Carmon & Ariely, 2000). This possible influence of fluctuations in attentional focus may not be noticeable when administering brief, one-shot measures of the endowment effect, such as the dichotomous choice measure, because children must focus their attention for only a short period of time. However, if such fluctuations do occur during the preference-card measure, intransitive responses may be indicative of underlying preference instability. This is an important distinction that has implications for our understanding of the endowment effect. If the endowment effect in children can be influenced in such a brief time span by attentional deficits, this would greatly contrast with the current notion that the endowment effect is a robust phenomenon. In addition, it would call the reliability of results based on one-shot measures such as the dichotomous choice measure into question.

5.2.2 Information processing

The development of information processing skills is characterized by improvements in response speed and verbal fluency until three to five years of age. However, substantial gains in processing speed do not take place until around nine and ten and, again, eleven and twelve years (for overview, see Anderson, 2002).

Differences in information processing abilities may account for the substantially larger endowment effect that we consistently observed in children as compared to adults due to resulting differences in deliberation time. Children typically required more time to complete the preference-card measure than adults, which is consistent with the developmental trajectory of executive functioning, in which response speed continues to improve into adolescence (cf., Anderson, 2002). Although we did not measure the actual difference in deliberation time between children and adults, previous studies indicate that even a difference as small as five seconds, which was presumably present in the studies reported in this manuscript, can significantly increase the size of the endowment effect (Ashby, et al., 2012). Thus, it seems plausible that the observed differences in effect magnitude between children and adults were caused, at least in part, by differences in deliberation time.

5.2.3 Cognitive flexibility

Regarding the domain of cognitive flexibility, there is evidence that children do not develop the ability to integrate information from multiple domains until approximately seven to nine years of age (Anderson, Anderson, Northam, & Taylor, 2000). Other studies, however, indicate that even preschool children possess this ability, although they cannot yet distinguish between relevant and irrelevant information (e.g., Betsch & Lang, 2012). The ability to integrate information from multiple domains is relevant to the occurrence of the endowment effect, as researchers have shown that the endowment effect may be caused, at least in part, because individuals primarily consider either attributes of the good, in the case of owners, or the money, in the case of nonowners (Carmon & Ariely, 2000). If children have even more difficultly integrating information from these two domains than adults, this might exaggerate the endowment effect. Thus, it is possible that the substantially larger endowment effect that we observed in children as compared to adults was due, at least in part, to differences in cognitive flexibility.

Working memory continually improves throughout childhood, with especially marked increases in performance seen between the ages of four and five years and after eight years (Luciana & Nelson, 1998). While four to seven year olds show similar performance to adults in terms of working memory when task demands are low, they perform substantially worse when task demands are high (Luciana & Nelson, 1998). Thus, differences in working memory ability may also account for the greater proportion of intransitive responders among children as compared to adults, as the measure requires participants to maintain their responses to prior cards present in working memory, in order to produce a transitive overall pattern of responses. This notion is supported by the findings in the pretest discussed in Study 2, where the proportion of intransitive responders was especially high when the preference-card measure was conducted in such a way as to place additional demands on working memory.

5.3 Limitations and future directions

There are several limitations associated with the studies reported in this manuscript, which may affect the reliability and generalisability of the findings. In the following, we discuss these limitations as well as how they may be addressed in future research.

We only examined the role of psychological ownership in the endowment effect as induced through the key experience of controlling the good. It is possible that psychological ownership has a different effect on individuals' valuations when elicited through control as opposed to the key experiences of familiarity and identification. For instance, researchers have found that valuations increase with both duration of ownership (Strahilevitz & Loewenstein, 1998) and number of exposures to the good (Zajonc, 1968)—both effects may potentially be driven by underlying psychological ownership, as familiarity presumably increases with both duration of ownership and number of exposures, while identification likely increases with duration of ownership. Thus, future studies should address the role of

psychological ownership in the endowment effect using manipulations related to key experiences other than control.

We did not address the role of psychological ownership in the endowment effect in children. The main reason why this variable was neglected in the child studies was a practical one: time constraints. That is, child participants visited our laboratory as part of a class trip that allotted only thirty minutes for completing the experiment. Because psychological ownership is presumably a novel concept for primary school children that would have required extensive explanation and instructions, time constraints prevented its inclusion in the child studies. This is unfortunate, as the examination of this variable in children would have served as a check of the ownership manipulation—i.e. if the manipulation was successful, one would expect owners to report higher levels of psychological ownership than nonowners. This would have increased the validity of our findings. It would also be interesting to determine whether psychological ownership plays a different role in the endowment effect for children than adults, as previous research indicates that children and adults have a different understanding of what ownership entails (Furby, 1978). However, before future studies can address this issue, one must first develop and validate a child-friendly measure of psychological ownership.

We were unable to test the possibility that intransitive responses on the preference card measure, especially those made by children, may have been due to preference instability due to changes in attentional focus. Thus, it is not possible to determine whether intransitive responses were due merely to inattentiveness or actual underlying changes in preferences. Because this has both methodological implications for the preference-card measure and theoretical implications for understanding the endowment effect, future studies addressing this issue would be valuable. For instance, one could develop a child-friendly version of the eye-tracking procedure used by Ashby and colleagues (2012). In addition, future studies are necessary to further test the reliability and validity of the preference-card measure.

We did not consider differences in deliberation time when designing and conducting Study 2 and 3, which may have at least partially accounted for the differences in the observed magnitude of the endowment effect in children and adults. Future studies comparing the endowment effect in participants of different ages should consider the possible interaction effect of age and deliberation time on the magnitude of the endowment effect. Controlling for this effect will help determine whether the substantially larger endowment effect that we observed in children reflects a real difference or is simply a research artifact due to differences in cognitive ability and thus longer deliberation times.

Finally, the sample sizes in Study 2 and 3 were somewhat small. For this reason, it was not possible to conduct more detailed analyses concerning the effect of age regarding both the magnitude of the endowment effect and the occurrence of intransitive responses. Future studies involving large samples of participants in each age group would greatly contribute to our understanding of both changes in the magnitude of the endowment effect across the life-span and possible underlying causes of these changes. It would be especially valuable if such studies additional include measures of executive functioning development, in order to examine its role in the endowment effect across the life-span.

5.4 Conclusion

Overall, the findings presented in this manuscript confirm that the endowment effect is a judgment bias in which *factual* ownership leads individuals to value a good more highly than if they did not own it. Owners must not experience psychological ownership in order for the effect to occur; nor is psychological ownership alone sufficient to cause the effect. Children as young as six years demonstrate an endowment effect on the preference-card measure that is substantially greater in magnitude than that observed in adults. Although this difference in effect magnitude may be due to differences in the amount of trading experience that children and adults have acquired, other factors such as developments in attentional

control and information processing abilities may also play an important role. Children appear to be more likely than adults to report intransitive responses on the preference-card measure, which may be due to their developmental stage in terms of attentional focus and/or cognitive flexibility. Regardless, intransitive responders appear to be equally susceptible to the endowment effect as transitive responders. The preference-card measure appears to be an economical and methodologically sound means with which to compare the endowment effect in children and adults, although studies evaluating its reliability and validity are still needed.

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